INSTRUCTION MANUAL

PHOENIX EX

3 TO 3500 HP
VECTOR AC DRIVE

US DRIVES, INC.

Made In the U.S.A.

Thank You

We at US Drives would like to say thank you for purchasing our product. We believe the Phoenix AC Drive Series is the most problem free product in the market today. If you have any questions or comments please feel free to call us. On behalf of all of us here once again thank you.

Recording Drive Information

It is a good idea to record all product nameplate information for future reference. The nameplate is usually mounted on the side of the drive. The following tables should be filled in during starting or prior to starting the drive.

Drive Part Number P/N	
Drive Serial Number S/N	
Software Revision Level SRL	

Free Software

Free software for setting and storing of parameters is available to all owners of the Phoenix AC Inverter Series.

Mounting Location of the Drive

The drive should be installed in a well ventilated, moisture free area. If there are: fumes; vapors; dirt; lint;, liquids or gases that can interact with the drive, then a clean air supply must be provided. The ambient temperature should not exceed the range of 14 F to 122 F (-10 C to 50 C). If the drive will be subject to vibration then the enclosure should be shock mounted.

Safety Warnings

AC drives, like all electrical equipment in industry, if not properly installed and operated can cause personal injury. Always use common sense when working around electrical equipment. Make sure you read this manual ***before*** any work on the drive begins. Never work on this drive if you are tired or under the influence of any drug. The drive must be grounded and installed in accordance with National Electrical Codes (NEC) and any local codes. Make sure that all power is disconnected, before working on the drive. ***Always*** measure the incoming voltage at the drive to make sure it is zero after disconnecting the power. Make sure all air passages are clear for proper cooling of the drive. After the drive is energized lethal voltages are present. ***Wait at least 5 minutes after disconnecting power before working on the drive,*** since high voltages will still be present. Call us if you have any questions.

Branch Circuit Protection

Branch circuit protection must be provided by the end user. In this manual you will find recommended fuse sizes and types for each module size.

Maintenance

If the enclosure is subject to foreign material, clean the enclosure and check any filters for build up of debris. If the inside of the enclosure needs cleaning, a low pressure vacuum cleaner is recommended. Do not use an air hose because of the possible oil vapor in the compressed air and its high pressure.

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1.0 INTRODUCTION

1.1 MANUAL OBJECTIVES

The purpose of this manual is to provide the user with the necessary information to install, program, start-up and maintain the PHOENIX Digital AC Drive. This manual should be read thoroughly before operating, servicing or setting up the PHOENIX Drive.

1.1.1 Who Should Use this Manual

This manual is intended for qualified service personnel responsible for setting up and servicing the PHOENIX AC Drive. You must have previous experience with and a basic understanding of electrical terminology, programming procedures, required equipment and safety precautions before attempting and service on the PHOENIX Drive.

1.2 SAFETY

1.2.1 General Safety Precautions

WARNING

Only personnel familiar with the PHOENIX Drive and the associated machinery should plan or implement the installation, start-up, and subsequent maintenance of the Drive. Failure to comply may result in personnel injury and/or equipment damage.

WARNING

An incorrectly applied or installed Drive can result in component damage or a reduction in product life. Wiring or application errors such as undersizing the motor, incorrect or inadequate AC supply or excessive ambient temperatures may result in damage to the Drive or motor.

WARNING

This Drive contains ESD (Electrostatic Discharge) sensitive parts and assemblies. Static control precautions are required when servicing or repairing this assembly. Component damage may result if ESD control procedures are not followed. If you are not familiar with static control procedures, please consult with the factory.

1.3 MODEL RATINGS

The following tables 1-1 through 1-3 show the PHOENIX model ratings for size 0 through size 4 for class 200, class 400 and class 500 units.

1.4 SPECIFICATIONS AND FEATURES

Electrical Specifications:

Rated Input Voltage:	200-250Vac, 380-500Vac, 500-600Vac -15% of minimum, +10% of maximum.
Frequency Tolerance:	45-65 Hz
Number of Phases:	3
Displacement Power Factor:	.95 or greater
Efficiency:	97% or greater at rated current
Max. Short Circuit Current Rating:	200,000A rms symmetrical, 600 volts (when used with AC input line fuses specified in tables 1-1 to 1-3).

Control Specifications:

Control Method:	Sine coded PWM with programmable carrier. Space Vector control.
Output Voltage:	0 to rated voltage.
Output Frequency Range:	0 to 600 Hz.
Frequency accuracy:	Analog reference: 0.1% of max frequency. Digital reference: 0.01% of max frequency.
Frequency resolution:	Analog reference: 0.06Hz at 60Hz. Digital reference: 0.001Hz at 60Hz.
Accel/Decel:	0.1 to 3276 sec.
Drive overload:	At Constant Torque: 150% of drive rated output for 1 minute. At Variable Torque: 120% of drive rated output for 1 minute.
Inverse Time Overload:	Programmable motor overload protection to comply with N.E.C. Article 430.
Current limit:	Proactive current limit programmable in % of motor rated current.
Braking torque:	Approximately 20%.
Maximum connected motor:	2 times rated drive horsepower.
Control power ride-thru:	2 seconds or greater, depending on load.

Environmental Specifications:

Ambient Temperature:	-10°C to 50°C (14°F to 122°F) Nema type 1 enclosed.
Storage Temperature:	-40°C to 70°C (-40°F to 158°F) Nema type 1 enclosed.
Altitude:	Sea level to 3300 Feet [1000m] without derating.
Humidity:	95% relative humidity non-condensing.
Vibration:	9.8m/sec^2 (1.0G) peak.
Immunity:	IEEE C62.41-1991 Category B (Formerly known as IEEE 587) EN50082-2 (Generic Immunity Standard).
Input R.F.I. Filter:	Standard on all models.

Physical attributes:

Mounting:	Though hole or panel mount for size 0 to size 3 drives. Size 4 drives are free standing enclosure.
Nema Rating:	Type 1 (IP20) as standard, Type 12 (IP54) optional.
Construction:	Steel construction (reduces E.M.I.)

Protective Features:

- Programmable speed sensitive motor overload protection to comply with UL 508C sections 43.3, 43.4 and 43.5.
- Drive overload protection to protect inverter.
- Motor stall protection at acceleration /deceleration and constant speed operation.
- Peak output current monitoring to protect against line-to-line shorts and line-to-ground shorts.
- Heatsink over-temperature monitoring.
- AC line overvoltage protection.
- DC bus over-voltage protection.
- DC bus under-voltage protection.
- Programmable stall protection.
- Control power ride-thru 2 seconds or greater, depending on load.
- Internal power supply monitoring.
- AC power loss detection.

- Critical speed rejection with programmable 3 points with bandwidth to avoid mechanical resonance.
- Flycatcher "catch a spinning motor".
- Password protection to prevent parameter changes by unauthorized personnel.
- 4 to 20ma reference loss detection.
- Programmable thresholds and more.

Control I/O:

- 8 Digital Inputs: 7 user programmable inputs and 1 dedicated input for "Stop", rated for 24Vdc logic control.
- 2 Digital Outputs: 2 programmable dry contacts rated 115Vac @ 5A; 30Vdc @ 3.5A.
- 2 analog inputs: -10 to +10V (10 bits) with input impedance: 75KΩ, or 4-20 mA @ 500Ω - Programmable.
- 2 analog outputs: -10 to +10V (10 bits) @ 2 mA max; output impedance = 100Ω. - Programmable.
- 1 voltage reference: +15Vdc reference @ 10 mA max.
- 24Vdc source: Use to power operator pushbuttons and US Drives option boards: 24Vdc @ 80 mA max.

Standard Drives Features:

- New generation IGBT.
- Nema type 1 (IP20) as standard for all models.
- 50°C ambient with standard Nema type 1 (IP20) enclosure.
- High voltage ratings: 250Vac+10% , 500Vac+10% models, and 600Vac+10% models
- Modbus RTU & Metasys N2 serial communications ready.
- Input line suppression: Metal oxide varistors for line-to-line and line-to-ground voltage surge protection.
- Built-in radio frequency filter.
- Nonvolatile parameter storage.
- All parameters are saved in EEPROM (nonvolatile).
- Autologging fault history: ten last faults recorded in order of occurrence.
- Internal control diagnostics.
- Simple programming through the Real-time Operator module (R.O.M.) with all data entries and monitoring in engineering units with English descriptions.
- Setpoint Control P.I.D.
- Injection DC Braking with braking time calculated automatically by the drive.
- Critical speed rejection.
- Programmable autorestart.
- Fixed or variable carrier (programmable).
- Programmable "Total Drive Run Time" accumulator.
- Parameter security code.
- User definable displays with programmable format and parameter scaling.
- 7 programmable digital inputs for custom setups.
- Metering: AC line voltage, motor current, motor voltage, DC Bus voltage, Kw, Kwh, running Kwh cost, and more…
- 8 programmable digital preset speeds with user selectable acceleration and deceleration rates.
- M.O.P. function.
- Programmable PWM carrier frequency, fixed or variable.
- Programmable thresholds.
- Programmable maintenance timers.
- Bi-directional auto-speed search (flycatcher) for starting into rotating loads.
- S-curve accel/decel control.
- Programmable time delay and logic functions (AND, OR, NOR) of bit parameters, digital inputs and outputs.
- Adding, subtracting, multiplying, dividing, ramping, limiting, and/or filtering functions of parameters and analog inputs and outputs.
- Parameters can be displayed, routed to an analog/digital output, or re-routed and used as an input parameter to control another function within the drive.
- User programmable functions and modes.
- Open Loop or closed-loop control operation easy setup.
- Precise control of motor speed and torque.
- Rigid and non-rigid position control including orientation.

Option Kits:	Catalog Number:
Isolated 4 to 20 ma Process Signal Output Card Availability: Factory Installed or Kit Form	3000-4040-120
115 Vac Operator (Digital Input) Interface Card Availability: Factory Installed or Kit Form	3000-4050
Removable USB/RS-485 Isolated Communications Interface with Cable Availability: Kit form	3000-4226-USB
Isolated Communications Card (RS-232/422/485, Modbus RTU, Metasys N2) Availability: Factory Installed or Kit Form	3000-4135
I/O Expansion Board Availability: Factory Installed or Kit Form	3000-4150
HOA Switch Availability: Factory Installed Only	P-HOA-SW
Local / Remote Switch Availability: Factory Installed Only	P-LR-SW
Auto / Manual Switch Availability: Factory Installed Only	P-AM-SW
Speed Potentiometer Availability: Factory Installed Only	P-POT
Automatic Bypass Adder For Size 0 Drive with Manual Bypass Availability: Factory Installed Only	P-ABP0
Automatic Bypass Adder For Size 1 Drive with Manual Bypass Availability: Factory Installed Only	P-ABP1
Automatic Bypass Adder For Size 2 Drive with Manual Bypass Availability: Factory Installed Only	P-ABP2
Automatic Bypass Adder For Size 3 Drive with Manual Bypass Availability: Factory Installed Only	P-ABP3
Bezel Assembly For Keypad Availability: Kit Form	P-BZL
Ribbon Cable Extender For Keypad – 6 Feet Availability: Kit Form	P-CBL-6
Remote Keypad Kit (Bezel with 10’ Ribbon Cable Extender) Availability: Kit Form	P-BZL-CBL-10
Remote Keypad Kit (Bezel with 20’ Ribbon Cable Extender) Availability: Kit Form	P-BZL-CBL-20
Floor Stand Kit for Nema 1 Enclosed Size 3 Drives	P-FS1
Extra Phoenix EX Instruction Manual (One Manual is provided per drive at no charge)	P-IM

Table 1-1

Class 200 Drive Models (Typical Voltage 208/230/240 VAC)

200-250VAC (-10% to +10%)												
Frame Designation	NEMA 1 (IP20) Catalog Number	Motor HP[1]		Continuous[2] Output Current (Amps)		Output KVA[3]		Input Current (Amps)		Input KVA[3]		Maximum Recommended AC Line Fuses[4] (Amps)
		HT	NT	HT	NT	HT	NT	HT	NT	HT	NT	
SIZE 0	E2-0005-N1	3	5	10	16	4	7	12	19	5	8	35
	E2-0007.5-N1	5	7.5	16	22	7	9	19	25	8	10	40
	E2-0010-N1	7.5	10	22	28	9	12	25	33	10	14	50
	E2-0015-N1	10	15	28	42	12	17	25	36	10	15	60
	E2-0020-N1	15	20	42	54	17	22	36	50	15	21	70
	E2-0020HT-N1	20	-	54	-	22	-	50	-	21	-	70
SIZE 1	E2-0025-N1	20	25	54	68	22	28	50	61	21	25	90
	E2-0030-N1	25	30	68	85	28	35	61	79	25	33	100
	E2-0030HT-N1	30	-	80	-	33	-	74	-	31	-	100
SIZE 2	E2-0040-N1	30	40	80	104	33	43	74	96	31	40	150
	E2-0050-N1	40	50	104	130	43	54	96	120	40	50	200
	E2-0060-N1	50	60	130	163	54	68	120	155	50	64	250
	E2-0075-N1	60	75	154	192	60	80	140	186	58	77	300
	E2-0100-N1	75	100	192	248	80	103	186	230	77	96	300
	E2-0100HT-N1	100	-	248	-	103	-	230	-	96	-	300
SIZE 3	E2-0125NT-N1	-	125	-	312	-	130	-	290	-	121	400
	E2-0125HT-N1	125	-	312	-	130	-	290	-	121	-	400
	E2-0150NT-N1	-	150	-	360	-	150	-	335	-	139	500
	E2-0150HT-N1	150	-	360	-	150	-	335	-	139	-	500
	E2-0200NT-N1	-	200	-	480	-	200	-	446	-	186	600
	E2-0200HT-N1	200	-	480	-	200	-	446	-	186	-	600
	E2-0250NT-N1	-	250	-	602	-	250	-	560	-	233	800
	E2-0250HT-N1	250	-	602	-	250	-	560	-	233	-	800

[1] Horsepower based on 220-240 Vac Motors.
[2] High Overload Torque (HT) rating is 150% for 1 minute; Normal Overload Torque (NT) rating is 120% for 1 minute.
[3] Output and Input KVA at nominal 240Vac
[4] UL Class T, J, and Semiconductor Fuses (preferred): Gould Shawmut A50Q, Bussmann FWH.
[5] Built-in as standard

Table 1-2

Class 400 Drive Models (Typical Voltage 380/415/480 VAC)

380-500VAC (-10% to +10%)												
Frame Designation	NEMA 1 (IP20) Catalog Number	Motor HP[1]		Continuous[2] Output Current (Amps)		Output KVA[3]		Input Current (Amps)		Input KVA[3]		Maximum Recommended AC Line Fuses[4] (Amps)
		HT	NT	HT	NT	HT	NT	HT	NT	HT	NT	
SIZE 0	E4-0007.5-N1	5	7.5	8	11	7	9	10	13	8	11	25
	E4-0010-N1	7.5	10	11	14	9	12	13	17	11	14	30
	E4-0015-N1	10	15	14	21	12	17	17	25	14	21	40
	E4-0020-N1	15	20	21	27	17	22	25	33	21	27	50
	E4-0025-N1	20	25	27	34	22	28	26	31	22	26	50
	E4-0030-N1	25	30	34	43	28	36	31	38	26	32	60
	E4-0040-N1	30	40	40	52	33	43	36	48	30	40	70
	E4-0040HT-N1	40	-	52	-	43	-	48	-	40	-	70
SIZE 1	E4-0050-N1	40	50	52	66	43	55	48	56	40	47	90
	E4-0060-N1	50	60	65	82	54	68	56	72	47	60	100
	E4-0060HT-N1	60	-	77	-	64	-	67	-	56	-	100
SIZE 2	E4-0075-N1	60	75	77	97	64	81	67	83	56	69	125
	E4-0100-N1	75	100	96	124	80	103	86	110	71	91	175
	E4-0125-N1	100	125	124	156	103	130	110	139	91	116	200
	E4-0150-N1	125	150	156	180	130	150	139	163	116	136	250
	E4-0200-N1	150	200	180	240	150	200	167	223	139	186	350
	E4-0200HT-N1	200	-	240	-	200	-	223	-	186	-	350
SIZE 3	E4-0250NT-N1	-	250	-	302	-	251	-	281	-	234	400
	E4-0250HT-N1	250	-	302	-	251	-	281	-	234	-	400
	E4-0300NT-N1	-	300	-	361	-	300	-	336	-	279	500
	E4-0300HT-N1	300	-	361	-	300	-	336	-	279	-	500
	E4-0350NT-N1	-	350	-	414	-	344	-	385	-	320	600
	E4-0350HT-N1	350	-	414	-	344	-	385	-	320	-	600
	E4-0400NT-N1	-	400	-	477	-	397	-	444	-	369	700
	E4-0400HT-N1	400	-	477	-	397	-	444	-	369	-	700
	E4-0450NT-N1	-	450	-	540	-	449	-	503	-	418	800
	E4-0450HT-N1	450	-	540	-	449	-	503	-	418	-	800
	E4-0500NT-N1	-	500	-	600	-	499	-	558	-	464	800
	E4-0500HT-N1	500	-	600	-	499	-	558	-	464	-	800
SIZE 4	E4-0600NT-N1	-	600	-	720	-	599	-	670	-	557	[5]
	E4-0600HT-N1	600	-	720	-	599	-	670	-	557	-	[5]
	E4-0700NT-N1	-	700	-	840	-	698	-	781	-	649	[5]
	E4-0700HT-N1	700	-	840	-	698	-	781	-	649	-	[5]
	E4-0800NT-N1	-	800	-	960	-	798	-	893	-	742	[5]
	E4-0800HT-N1	800	-	960	-	798	-	893	-	742	-	[5]
	E4-0900NT-N1	-	900	-	1080	-	898	-	1004	-	835	[5]
	E4-0900HT-N1	900	-	1080	-	898	-	1004	-	835	-	[5]
	E4-1000NT-N1	-	1000	-	1200	-	998	-	1116	-	928	[5]
	E4-1000HT-N1	1000	-	1200	-	998	-	1116	-	928	-	[5]
	E4-1250NT-N1	-	1250	-	1500	-	1247	-	1395	-	1160	[5]
	E4-1250HT-N1	1250	-	1500	-	1247	-	1395	-	1160	-	[5]
	E4-1500NT-N1	-	1500	-	1800	-	1496	-	1674	-	1392	[5]
	E4-1500HT-N1	1500	-	1800	-	1496	-	1674	-	1392	-	[5]
	E4-1750NT-N1	-	1750	-	2100	-	1746	-	1953	-	1624	[5]
	E4-1750HT-N1	1750	-	2100	-	1746	-	1953	-	1624	-	[5]
	E4-2000NT-N1	-	2000	-	2400	-	1995	-	2232	-	1856	[5]
	E4-2000HT-N1	2000	-	2400	-	1995	-	2232	-	1856	-	[5]
	E4-2500NT-N1	-	2500	-	3000	-	2494	-	2790	-	2320	[5]
	E4-2500HT-N1	2500	-	3000	-	2494	-	2790	-	2320	-	[5]

THIS VOLTAGE SERIES HAS A MAXIMUM HP RATING OF 3,OOOHP.

[1] Horsepower based on 440-480 Vac Motors.

[2] High Overload Torque (HT) rating is 150% for 1 minute; Normal Overload Torque (NT) rating is 120% for 1 minute.

[3] Output and Input KVA at nominal voltage 480Vac

[4] UL Class T, J, and Semiconductor Fuses (preferred): Gould Shawmut A50Q, Bussmann FWH.

[5] Built-in as standard

Table 1-3

Class 500 Drive Models (Typical Voltage 525/575/600 VAC)

500-600VAC (-10% to +10%)												
Frame Designation	NEMA 1 (IP20) Catalog Number	Motor HP[1]		Continuous[2] Output Current (Amps)		Output KVA[3]		Input Current (Amps)		Input KVA[3]		Maximum Recommended AC Line Fuses[4] (Amps)
		HT	NT	HT	NT	HT	NT	HT	NT	HT	NT	
SIZE 0	E5-0007.5-N1	5	7.5	7	9	7	9	9	11	9	11	20
	E5-0010-N1	7.5	10	9	12	9	12	11	13	11	13	25
	E5-0015-N1	10	15	11	17	11	17	13	20	13	20	35
	E5-0020-N1	15	20	17	22	17	22	20	25	20	25	40
	E5-0025-N1	20	25	22	28	22	28	22	28	22	28	40
	E5-0030-N1	25	30	27	34	27	34	27	34	27	34	50
	E5-0040-N1	30	40	32	41	32	41	32	40	32	40	60
	E5-0040HT-N1	40	-	41	-	41	-	40	-	40	-	60
SIZE 1	E5-0050-N1	40	50	41	52	41	52	40	48	40	48	80
	E5-0060-N1	50	60	52	65	52	65	54	61	54	61	90
	E5-0075-N1	60	75	62	78	62	78	58	72	58	72	100
	E5-0075HT-N1	75	-	77	-	77	-	75	-	75	-	150
SIZE 2	E5-0100-N1	75	100	77	99	77	99	75	96	75	96	150
	E5-0125-N1	100	125	99	125	99	124	96	124	96	123	175
	E5-0150-N1	125	150	125	157	124	156	124	154	123	153	200
	E5-0200-N1	150	200	144	192	143	191	142	191	141	190	300
	E5-0200HT-N1	200	-	192	-	191	-	191	-	190	-	300
SIZE 3	E5-0250NT-N1	-	250	-	242	-	241	-	240	-	239	350
	E5-0250HT-N1	250	-	242	-	241	-	240	-	239	-	350
	E5-0300NT-N1	-	300	-	289	-	288	-	286	-	285	400
	E5-0300HT-N1	300	-	289	-	288	-	286	-	285	-	400
	E5-0350NT-N1	-	350	-	336	-	335	-	333	-	331	500
	E5-0350HT-N1	350	-	336	-	335	-	333	-	331	-	500
	E5-0400NT-N1	-	400	-	382	-	380	-	378	-	377	600
	E5-0400HT-N1	400	-	382	-	380	-	378	-	377	-	600
	E5-0450NT-N1	-	450	-	432	-	430	-	428	-	426	700
	E5-0450HT-N1	450	-	432	-	430	-	428	-	426	-	700
	E5-0500NT-N1	-	500	-	472	-	470	-	467	-	465	700
	E5-0500HT-N1	500	-	472	-	470	-	467	-	465	-	700
	E5-0600NT-N1	-	600	-	576	-	574	-	570	-	568	800
	E5-0600HT-N1	600	-	576	-	574	-	570	-	568	-	800
SIZE 4	E5-0700NT-N1	-	700	-	672	-	669	-	665	-	663	5
	E5-0700HT-N1	700	-	672	-	669	-	665	-	663	-	5
	E5-0800NT-N1	-	800	-	768	-	765	-	760	-	757	5
	E5-0800HT-N1	800	-	768	-	765	-	760	-	757	-	5
	E5-0900NT-N1	-	900	-	864	-	860	-	855	-	852	5
	E5-0900HT-N1	900	-	864	-	860	-	855	-	852	-	5
	E5-1000NT-N1	-	1000	-	960	-	956	-	950	-	947	5
	E5-1000HT-N1	1000	-	960	-	956	-	950	-	947	-	5
	E5-1250NT-N1	-	1250	-	1200	-	1195	-	1188	-	1183	5
	E5-1250HT-N1	1250	-	1200	-	1195	-	1188	-	1183	-	5
	E5-1500NT-N1	-	1500	-	1440	-	1434	-	1426	-	1420	5
	E5-1500HT-N1	1500	-	1440	-	1434	-	1426	-	1420	-	5
	E5-1750NT-N1	-	1750	-	1680	-	1673	-	1663	-	1656	5
	E5-1750HT-N1	1750	-	1680	-	1673	-	1663	-	1656	-	5
	E5-2000NT-N1	-	2000	-	1920	-	1912	-	1901	-	1893	5
	E5-2000HT-N1	2000	-	1920	-	1912	-	1901	-	1893	-	5
	E5-2500NT-N1	-	2500	-	2400	-	2390	-	2376	-	2366	5
	E5-2500HT-N1	2500	-	2400	-	2390	-	2376	-	2366	-	5

THIS VOLTAGE SERIES HAS A MAXIMUM HP RATING OF 3,500HP.

[1] Horsepower based on 550-600 Vac Motors.

[2] High Overload Torque (HT) rating is 150% for 1 minute; Normal Overload Torque (NT) rating is 120% for 1 minute.

[3] Output and Input KVA at nominal voltage 575Vac.

[4] UL Class T, CC, J, and Semiconductor Fuses (preferred): Gould Shawmut A70Q, Bussmann FWP.

[5] Built-in as standard

END INTRODUCTION SECTION

2.0 INSTALLATION AND WIRING

Section 2.0 provides the information needed to properly mount and wire the PHOENIX Drive. Since most start-up difficulties are the result of incorrect wiring, it is essential that the wiring is done as instructed. Read and understand this section in its entirety before actual installation begins.

2.1 SAFETY WARNINGS

WARNING

Only qualified electrical personnel familiar with the construction and operation of this equipment and the hazards involved should install, adjust, operate or service this equipment.

WARNING

The control and its associated motors and operator control devices must be installed and grounded in accordance with all national and local codes (NEC, VDE 0160, BSI, etc.). To reduce the potential for electric shock, disconnect all power sources before initiating any maintenance or repairs. Keep fingers and foreign objects away from ventilation and other openings. Keep air passages clear. Potentially lethal voltages exist within the drive enclosure and connections. Use extreme caution during installation and start-up.

WARNING

The following information is only a guide for proper installation. US Drives cannot assume responsibility for the compliance or noncompliance to any code, national, local or otherwise for the proper installation of this drive or associated equipment. A hazard of personal injury and/or equipment damage exists if codes are ignored during the installation.

2.2 INITIAL CHECKS

Before installing the PHOENIX Drive, check the unit for physical damage sustained during shipment. If damaged, file a claim with the shipper and return for repair following the procedures outlined on the back cover. If no damage is observed, remove all shipping restraints and padding. Check drive nameplate data for conformance with the AC power source and motor.

2.3 DETERMINING CONTROL LOCATION

The PHOENIX Drive is suitable for most well-ventilated factory areas where industrial equipment is installed. Locations subject to steam vapors or excessive moisture, oil vapors, flammable or combustible vapors, chemical fumes, corrosive gases or liquids, or excessive dirt, dust or lint should be avoided unless an appropriate enclosure has been supplied or a source of clean air is supplied to the enclosure. The location should be dry and the ambient temperature should not exceed 122°F (50°C). If the mounting location is subject to vibration, the unit should be shock mounted.

2.4 MOUNTING

Figure 2-1 shows the minimum required surrounding air space for panel mounted PHOENIX Drives (size 0 through size 3 units). Note that the panel mounted units must be mounted in an upright position. Figure 2-2a shows dimensional information for size 1 through size 2 units. Figure 2-2 shows dimensional information for size 0. Figure 2-2b shows dimensional information for size 3. If through panel mounting is chosen (available on size 0 through size 3 Drives), a suitable sealant should be applied to the mounting faces of the drive and the panel to prevent leakage.

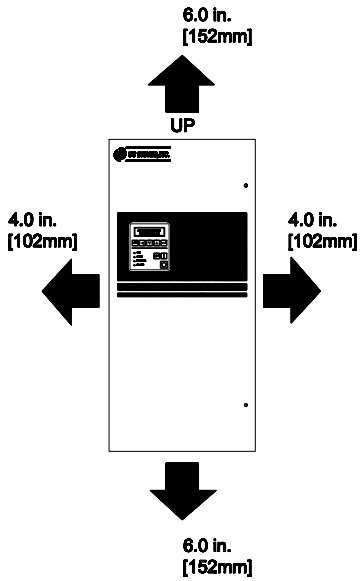
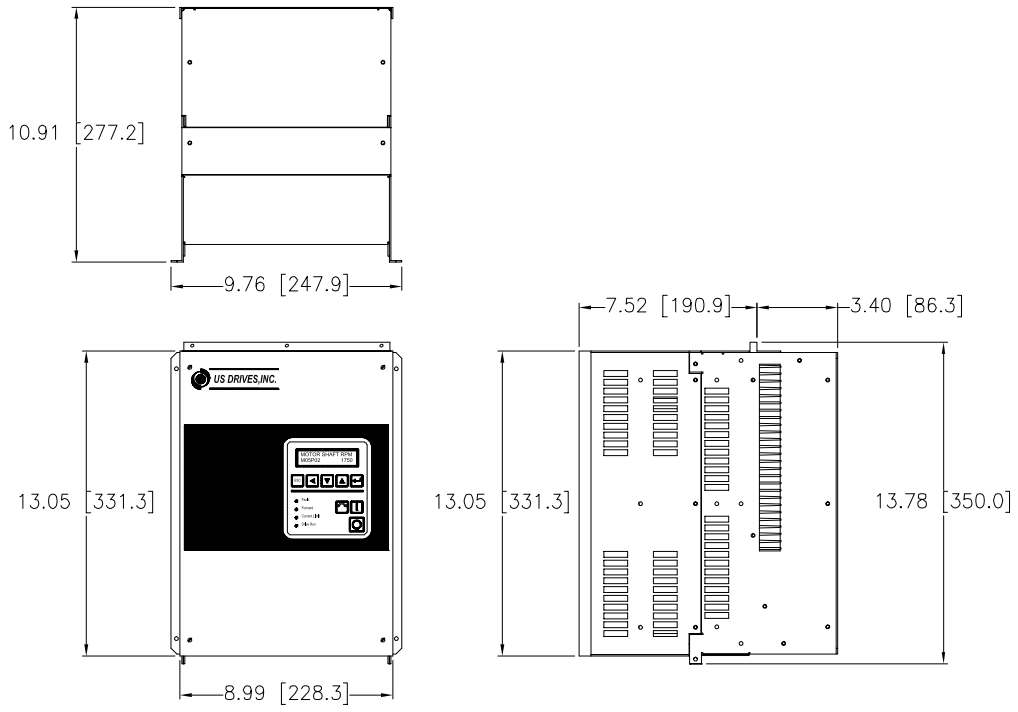
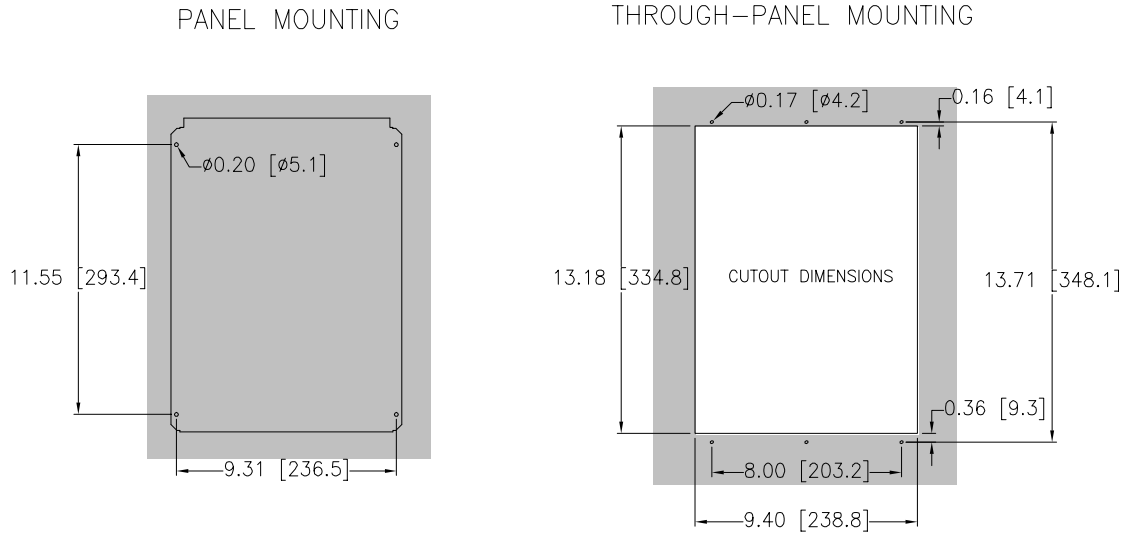


Figure 2-1

Minimum Required Surrounding Air Space for size 0 through size 3 PHOENIX Drives

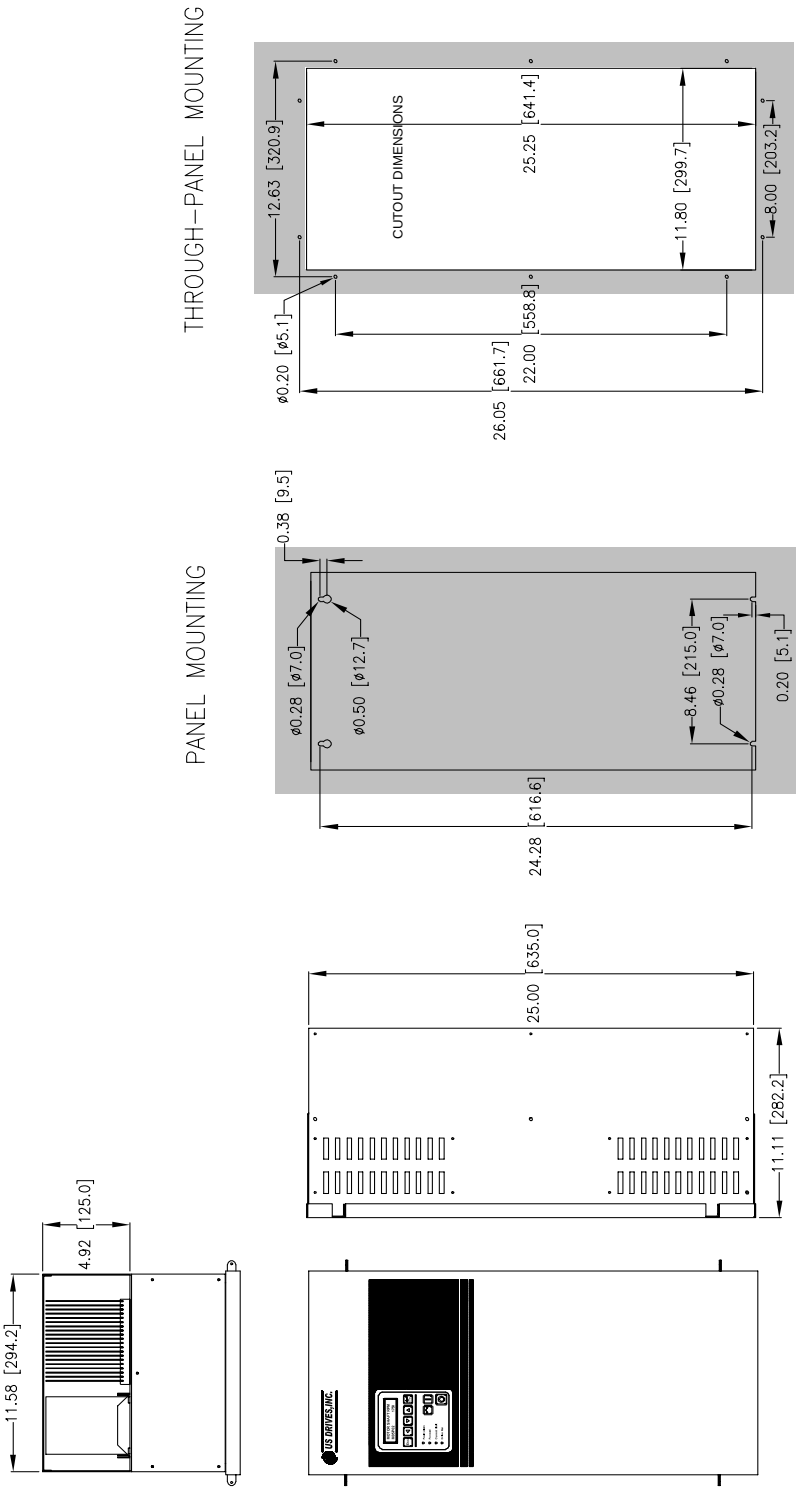




Approximate Weight: 30 Lbs. [14 Kgs]

Notes:
- Top and bottom endplates are removable to gain access inside the drive and to punch holes for conduits.
- End plates must be removed from the drive before drilling and punching holes to avoid metal dust inside the drive enclosure. Failure to do so will cause damage to the drive.
- For through-panel mounting, customer is to seal gap on both sides of cutout. Provided by customer, aluminum angle 1” x 1” x 0.050” can be used to attach to left and right sides of the drive to help seal and secure the drive.

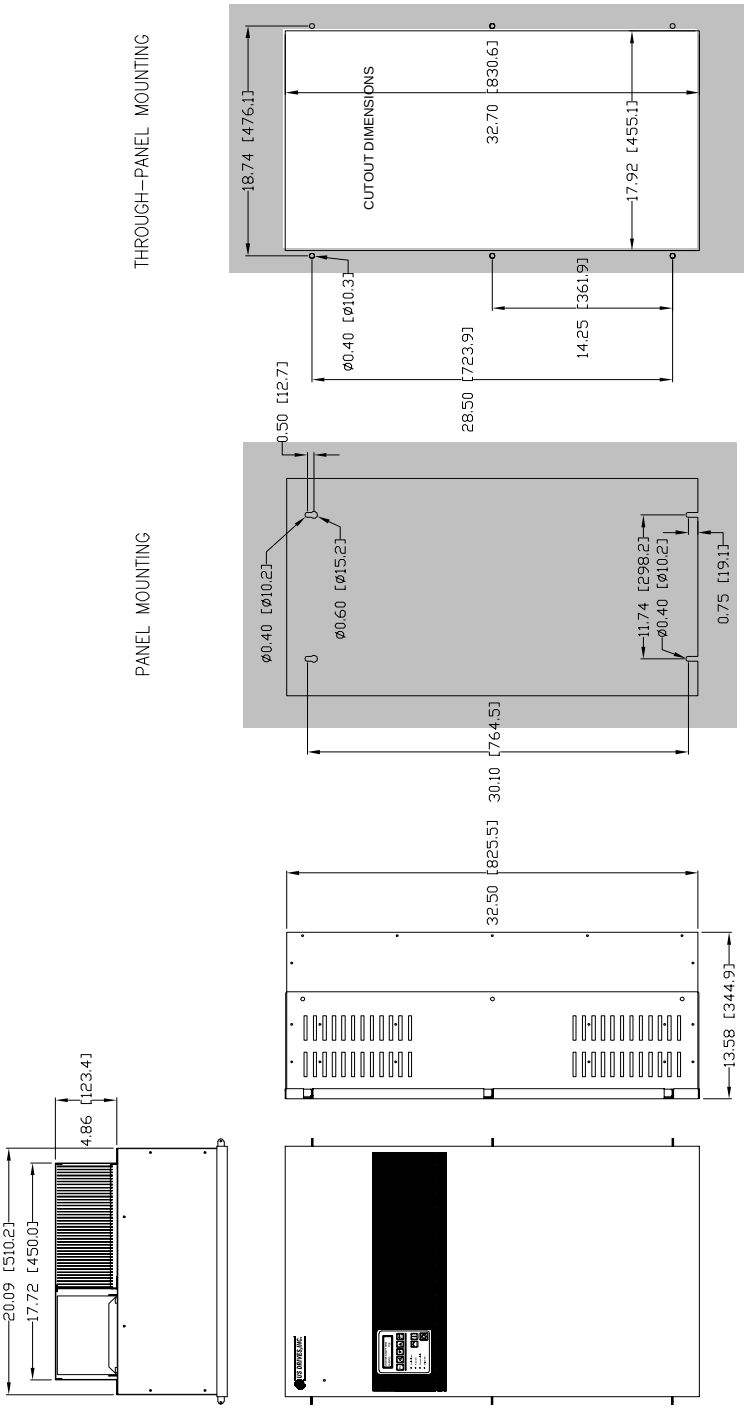
Figure 2-2
PHOENIX Mounting Information
Size 0 (Nema Type 1)



Approximate Weight: 75 Lbs. [34 Kgs]

Notes:
- Top and bottom endplates are removable to gain access inside the drive and to punch holes for conduits.
- End plates must be removed from the drive before drilling and punching holes to avoid metal dust inside the drive enclosure. Failure to do so will cause damage to the drive.
- For through-panel mounting, customer is to seal gap on both sides of cutout. Provided by customer, aluminum angle 1" x 1" x 0.050" can be used to attach to left and right sides of the drive to help seal and secure the drive.

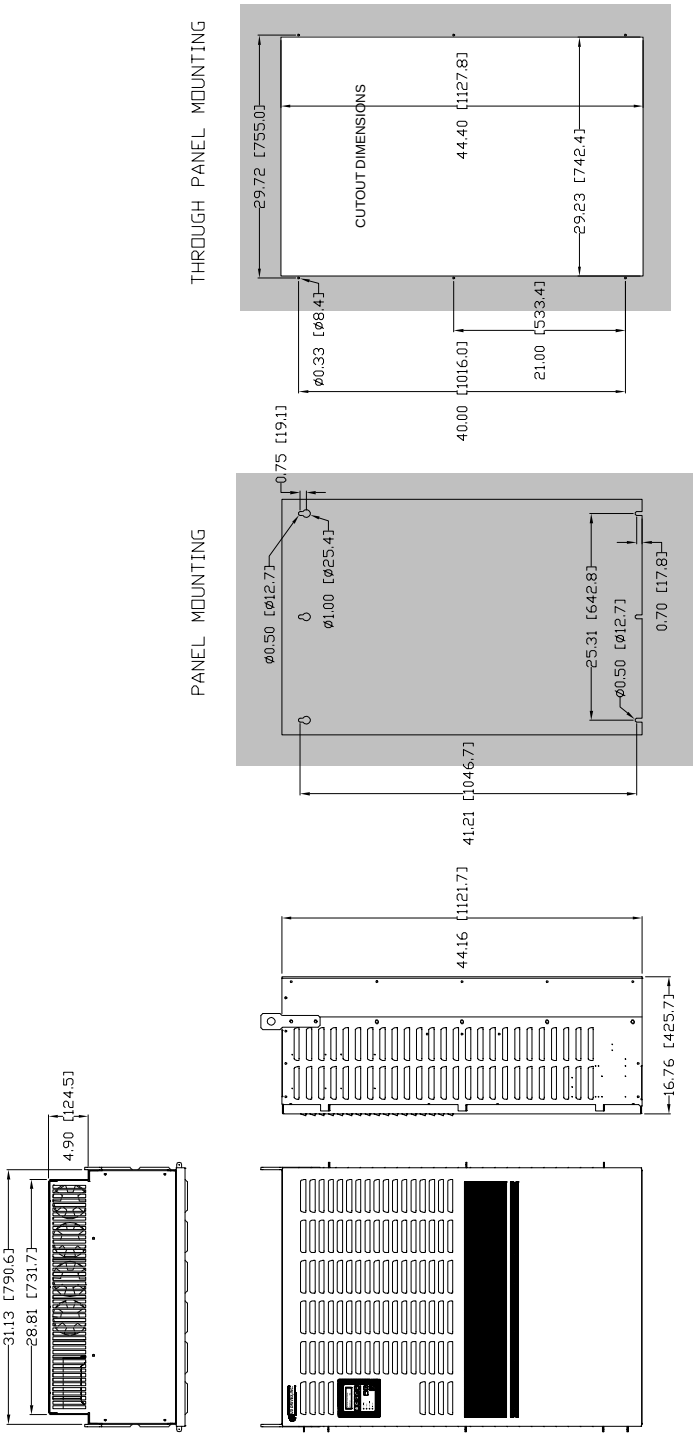
Figure 2-2a
PHOENIX Mounting Information
Size 1 (Nema Type 1)



Approximate Weight: 180 Lbs. [82 Kgs]

Notes:
- Top and bottom endplates are removable to gain access inside the drive and to punch holes for conduits.
- End plates must be removed from the drive before drilling and punching holes to avoid metal dust inside the drive enclosure. Failure to do so will cause damage to the drive.
- For through-panel mounting, customer is to seal gap on both sides of cutout. Provided by customer, aluminum angle 1" x 1" x 0.050" can be used to attach to left and right sides of the drive to help seal and secure the drive.

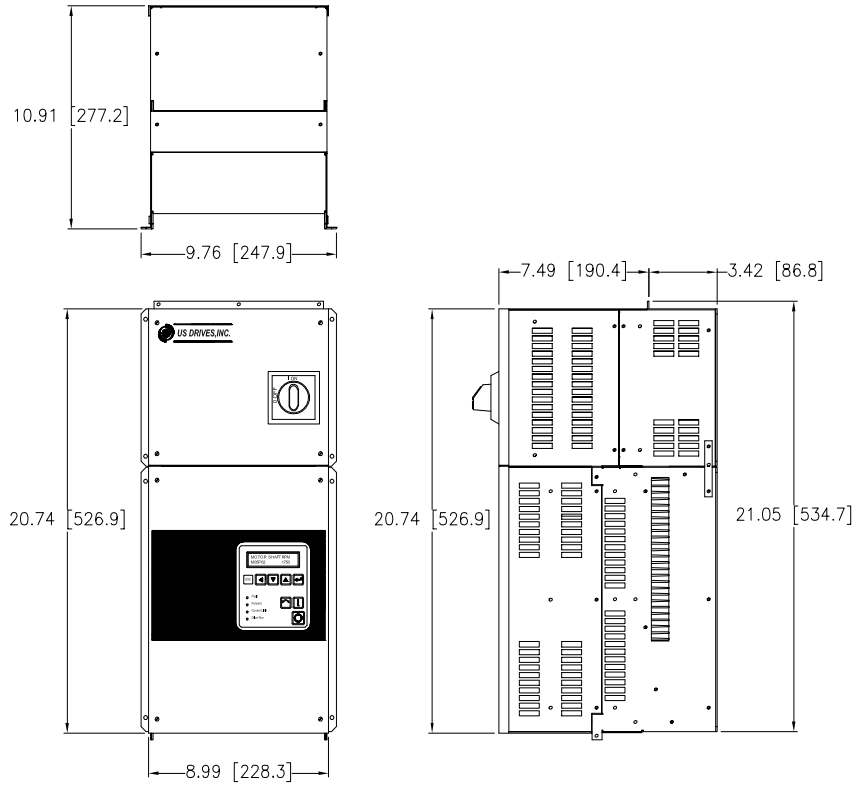
Figure 2-2b
PHOENIX Mounting Information
Size 2 (Nema Type 1)

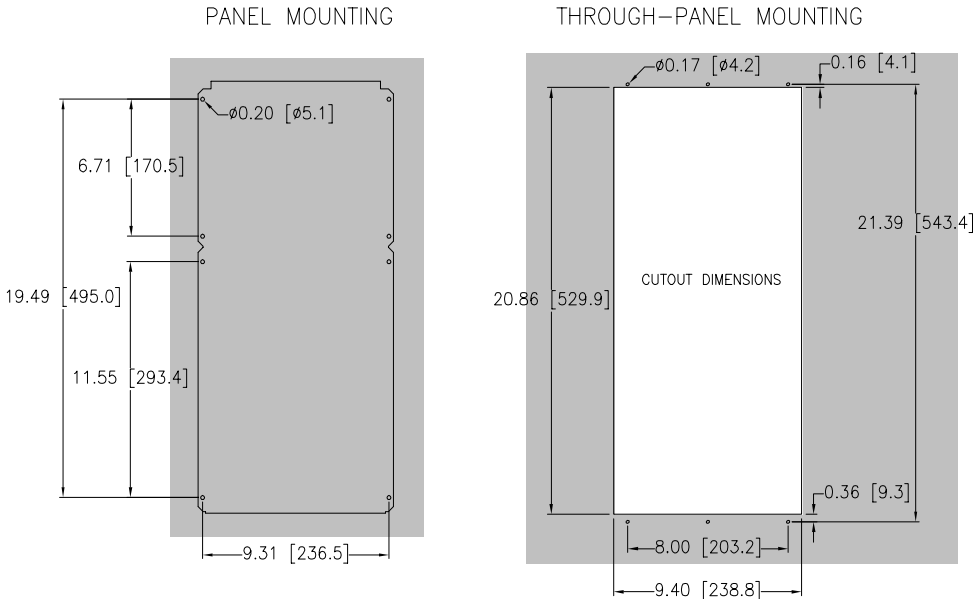


Approximate Weight: 500 Lbs. [227 Kgs]

Notes:
- Top and bottom endplates are removable to gain access inside the drive and to punch holes for conduits.
- End plates must be removed from the drive before drilling and punching holes to avoid metal dust inside the drive enclosure. Failure to do so will cause damage to the drive.
- For through-panel mounting, customer is to seal gap on both sides of cutout. Provided by customer, aluminum angle 1" x 1" x 0.050" can be used to attach to left and right sides of the drive to help seal and secure the drive.
- Size 3 enclosures can also be free-standing with optional floor stand kit from US Drives, Inc.
- All Size 4 drives are free-standing enclosures. Consult factory for dimensions.

Figure 2-2c
PHOENIX Mounting Information
Size 3 (Nema Type 1)

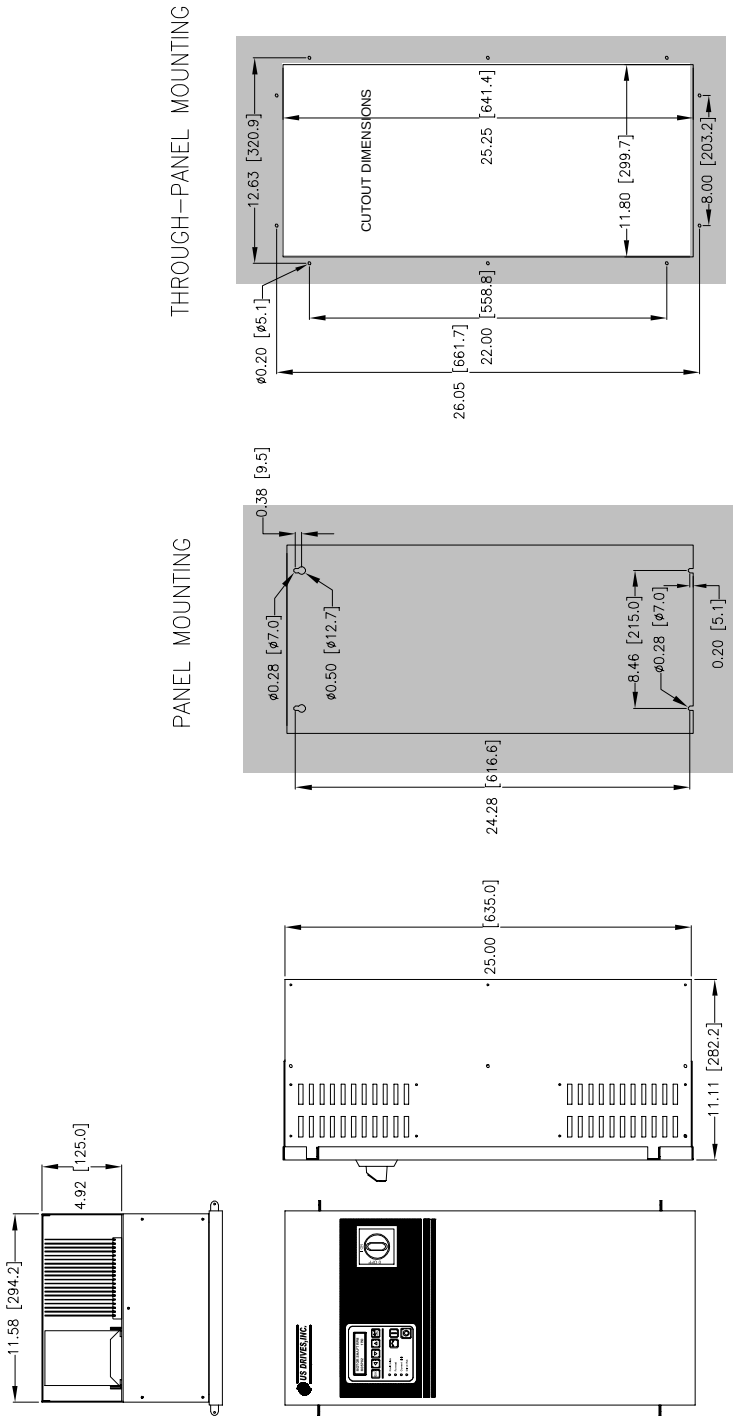




Approximate Weight: 42 Lbs. [19 Kgs]

Notes:
- Top and bottom endplates are removable to gain access inside the drive and to punch holes for conduits.
- End plates must be removed from the drive before drilling and punching holes to avoid metal dust inside the drive enclosure. Failure to do so will cause damage to the drive.
- For through-panel mounting, customer is to seal gap on both sides of cutout. Provided by customer, aluminum angle 1" x 1" x 0.050" can be used to attach to left and right sides of the drive to help seal and secure the drive.

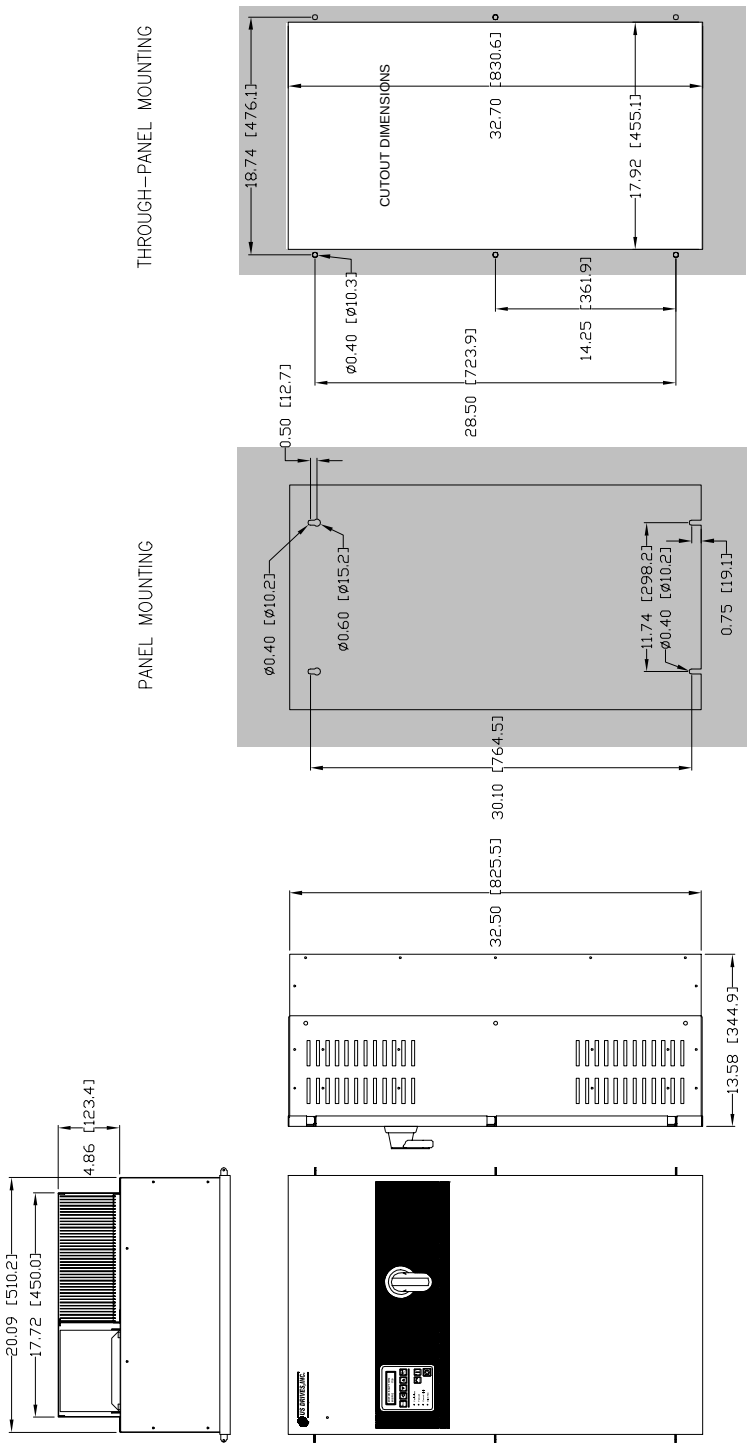
Figure 2-2d
PHOENIX Mounting Information
Size 0 with Disconnect Switch and Fuses (Nema Type 1)



Approximate Weight: 85 Lbs. [39 Kgs]

Notes:
- Top and bottom endplates are removable to gain access inside the drive and to punch holes for conduits.
- End plates must be removed from the drive before drilling and punching holes to avoid metal dust inside the drive enclosure. Failure to do so will cause damage to the drive.
- For through-panel mounting, customer is to seal gap on both sides of cutout. Provided by customer, aluminum angle 1" x 1" x 0.050" can be used to attach to left and right sides of the drive to help seal and secure the drive.

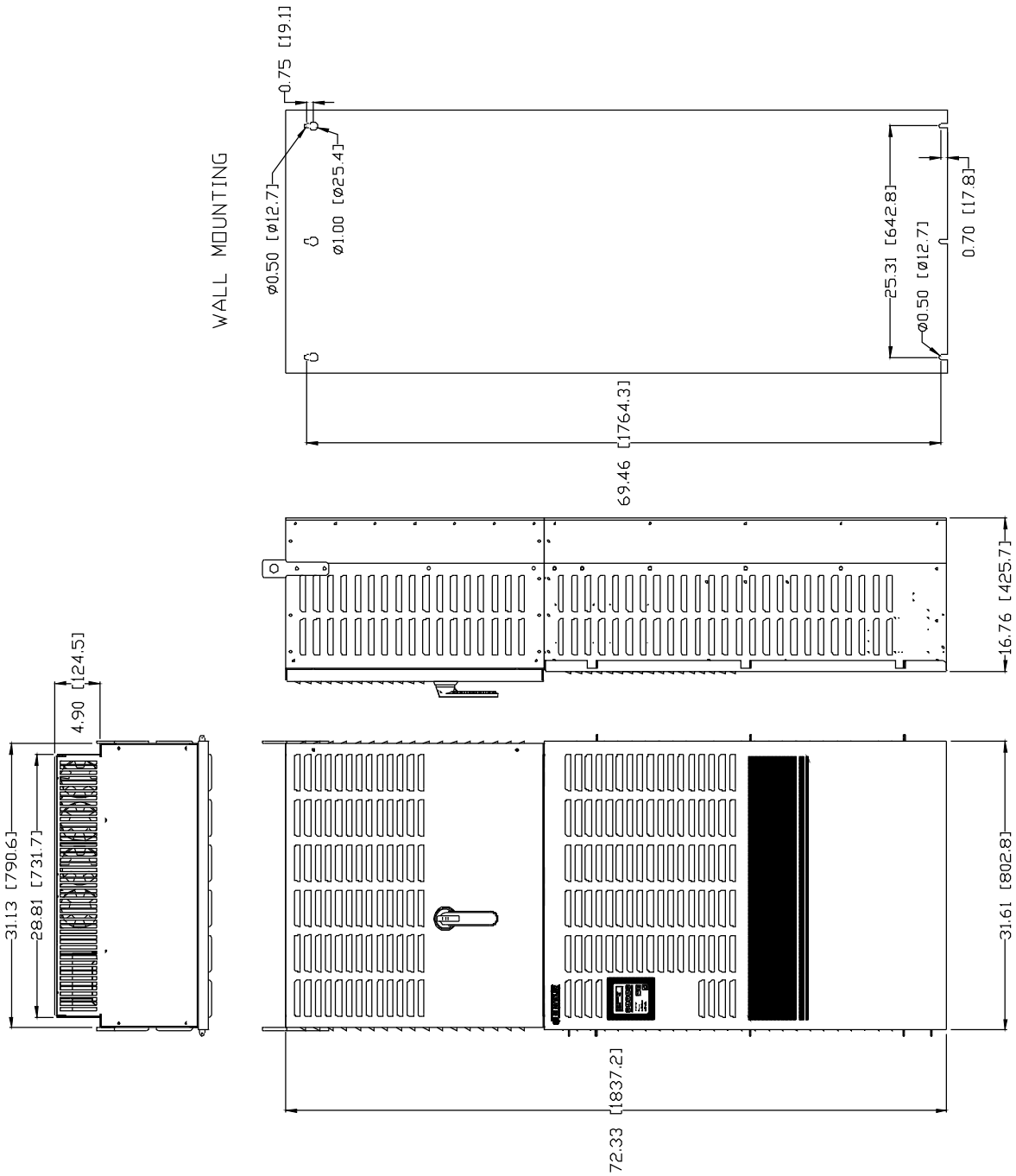
Figure 2-2e
PHOENIX Mounting Information
Size 1 with Disconnect Switch and Fuses (Nema Type 1)



Approximate Weight: 190 Lbs. [86 Kgs]

Notes:
- Top and bottom endplates are removable to gain access inside the drive and to punch holes for conduits.
- End plates must be removed from the drive before drilling and punching holes to avoid metal dust inside the drive enclosure. Failure to do so will cause damage to the drive.
- For through-panel mounting, customer is to seal gap on both sides of cutout. Provided by customer, aluminum angle 1" x 1" x 0.050" can be used to attach to left and right sides of the drive to help seal and secure the drive.

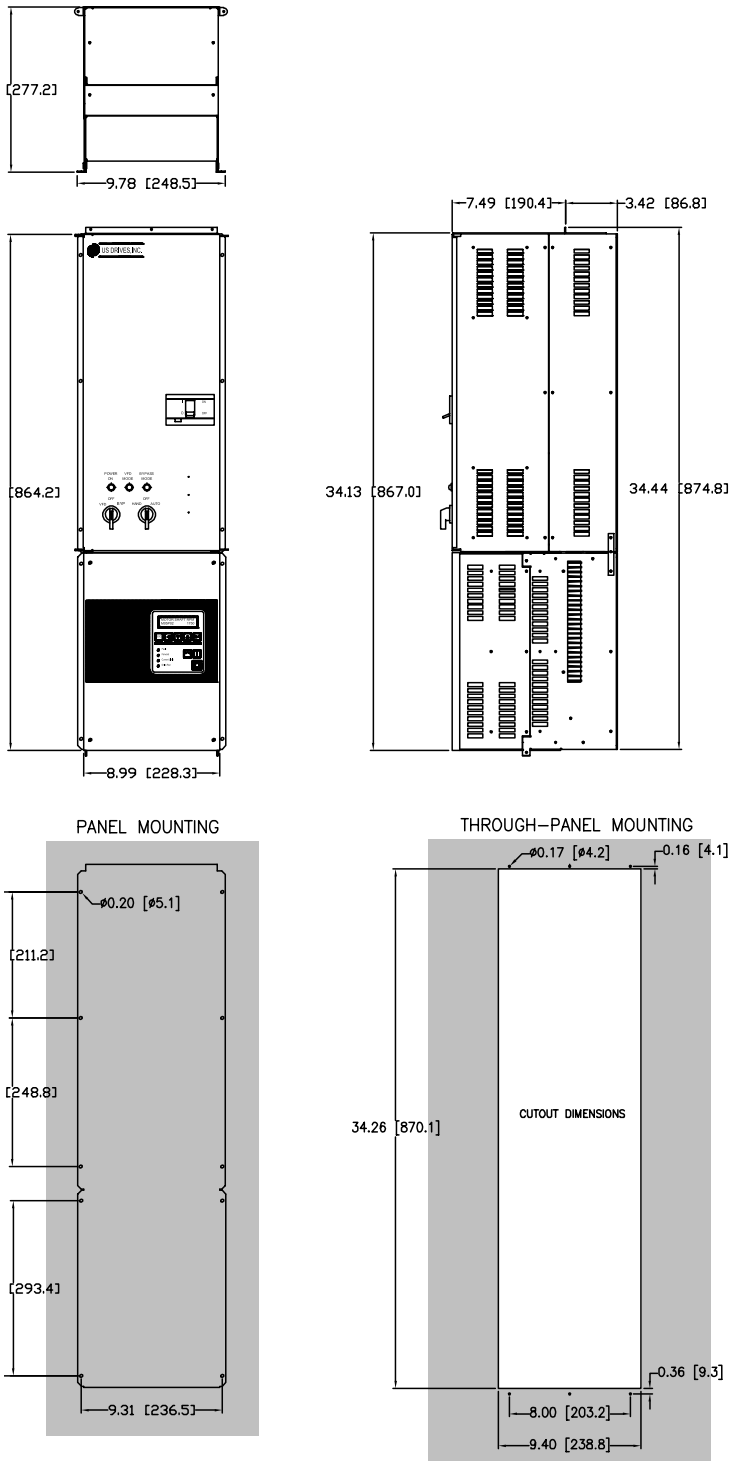
Figure 2-2f
PHOENIX Mounting Information
Size 2 with Disconnect Switch and Fuses (Nema Type 1)



Approximate Weight: 700 Lbs. [318 Kgs]

Notes:
- Top and bottom endplates are removable to gain access inside the drive and to punch holes for conduits.
- End plates must be removed from the drive before drilling and punching holes to avoid metal dust inside the drive enclosure. Failure to do so will cause damage to the drive.

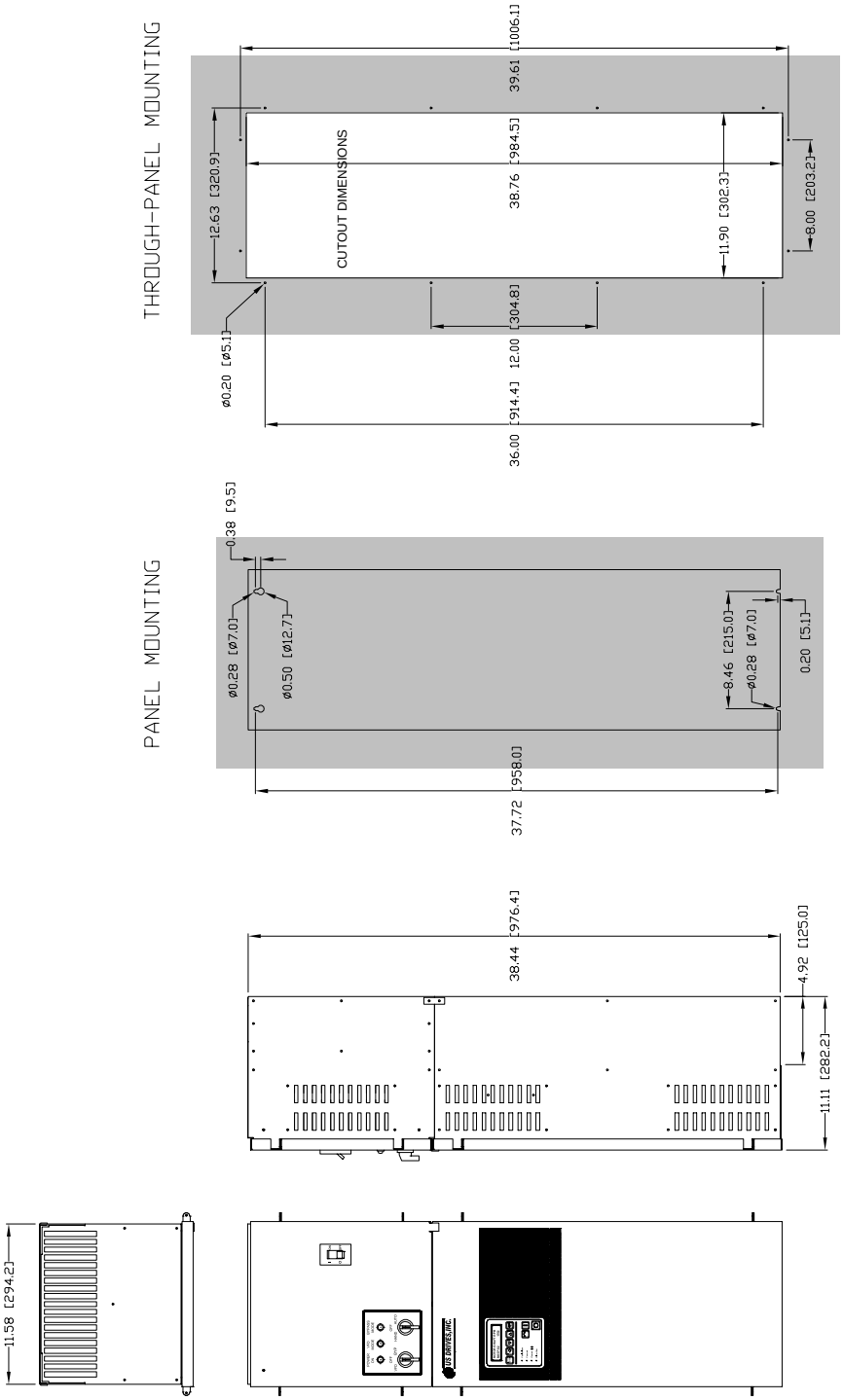
Figure 2-2g
PHOENIX Mounting Information
Size 3 with Disconnect Switch and Fuses (Nema Type 1)



Approximate Weight: 75 Lbs. [34 Kgs]

Notes:
- Top and bottom endplates are removable to gain access inside the drive and to punch holes for conduits.
- End plates must be removed from the drive before drilling and punching holes to avoid metal dust inside the drive enclosure. Failure to do so will cause damage to the drive.
- For through-panel mounting, customer is to seal gap on both sides of cutout. Provided by customer, aluminum angle 1" x 1" x 0.050" can be used to attach to left and right sides of the drive to help seal and secure the drive.

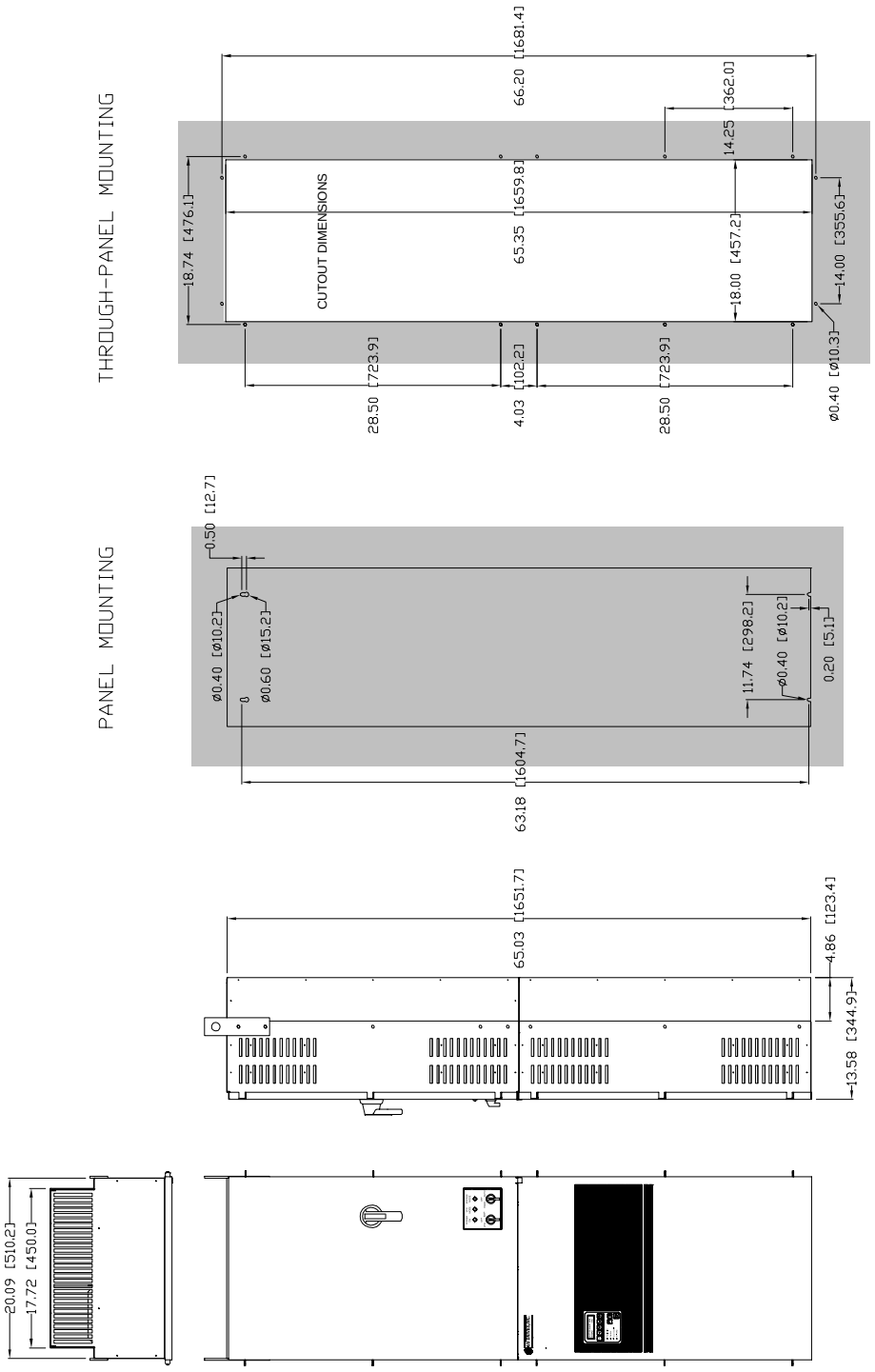
Figure 2-2h
PHOENIX Mounting Information
Size 0 with Bypass (Nema Type 1)



Approximate Weight: 120 Lbs. [55 Kgs]

Notes:
- Top and bottom endplates are removable to gain access inside the drive and to punch holes for conduits.
- End plates must be removed from the drive before drilling and punching holes to avoid metal dust inside the drive enclosure. Failure to do so will cause damage to the drive.
- For through-panel mounting, customer is to seal gap on both sides of cutout. Provided by customer, aluminum angle 1" x 1" x 0.050" can be used to attach to left and right sides of the drive to help seal and secure the drive.

Figure 2-2i
PHOENIX Mounting Information
Size 1 with Bypass (Nema Type 1)



Approximate Weight: 250 Lbs. [114 Kgs]

Notes:
- Top and bottom endplates are removable to gain access inside the drive and to punch holes for conduits.
- End plates must be removed from the drive before drilling and punching holes to avoid metal dust inside the drive enclosure. Failure to do so will cause damage to the drive.
- For through-panel mounting, customer is to seal gap on both sides of cutout. Provided by customer, aluminum angle 1" x 1" x 0.050" can be used to attach to left and right sides of the drive to help seal and secure the drive.

Figure 2-2j
PHOENIX Mounting Information
Size 2 with Bypass (Nema Type 1)

2.5 AC SUPPLY SOURCE

PHOENIX Drives are suitable for use on a power system capable of delivering up to a maximum of 200,000 rms symmetrical amperes, 250/500/600 +10% volts maximum when used with AC input line fuses specified in tables 1-1, 1-2 and 1-3 respectively.

WARNING

To guard against personal injury and/or equipment damage caused by improper fusing, use only the recommended line fuses specified in tables 1-1, 1-2 and 1-3.

2.5.1 Unbalanced Distribution Systems

The PHOENIX Drive is designed to operate on three-phase supply systems whose line voltages are symmetrical. Surge suppression devices are included to protect the drive from lightning induced overvoltages between line and ground. Where the potential exists for abnormally high phase-to-ground voltages (in excess of one hundred twenty-five percent (125%) of the nominal line-to-line voltage), or where the supply ground is tied to another system or equipment that could cause the ground potential to vary with operation, suitable isolation is required for the drive. Where this condition exists, an isolation transformer is **strongly recommended**.

2.5.2 Ungrounded Distribution Systems

All Phoenix drives are equipped with MOVs that provides voltage surge protection and phase-to-phase plus phase-to-ground protection which is designed to meet IEEE 587. Where the potential exists for abnormally high phase-to-ground voltages (in excess of one hundred twent-five percent (125%) of the nominal line-to-line voltage), an isolation transformer is strongly recommended. The MOV circuit is designed for surge suppression only (transient line protection), not continuous operation. With ungrounded distribution systems, the phase-to-ground MOV connection could become a continuous current path to ground.

If the AC source for the drive does not have a ground reference (neutral or phase ground), an isolation transformer with the neutral of the secondary grounded is highly recommended. These drives contain PE referenced MOV devices for input transient voltage limiting. Transients occurring on a non-ground referenced voltage source may generate excessive line to ground voltages which could exceed the limits of the insulation system of the drive. Under these conditions, it is highly recommended that a system level transient voltage suppression device be employed in order to limit the potential line to ground voltage. Contact factory If the drive must be operated on an ungrounded voltage source.

2.5.3 Input Power Conditioning

Since all PHOENIX Drives (E2-0125 and higher, E4-0250 and higher, E5-0250 and higher) have a built in three percent (3%) bus reactor, an external line reactor or isolation transformer is generally not required. Under extreme conditions, however, an external line reactor or isolation transformer may be required.

The basic guidelines for determining if a line reactor or isolation transformer is required are as follows:

1. If the AC input power system does not have a neutral or one phase referenced to ground (see section 2.5.2), an isolation transformer with the neutral of the secondary grounded is **highly recommended**. If the line-to-ground voltages on any phase can exceed one hundred twenty-five percent (125%) of the nominal line-to-line voltage, an isolation transformer with the neutral of the secondary grounded, is **always required**.
2. If the AC line supplying the drive has power factor correction capacitors that are switched in and out, an isolation transformer or three percent (3%) line reactors are recommended between the drive and the capacitors.
3. If the AC line frequently experiences transient power interruptions or significant voltage spikes, an isolation transformer or three percent (3%) reactor is recommended.

2.5.4 Input Fusing

WARNING

PHOENIX Drives sizes 0 through 3 do not provide input power short circuit fusing. Maximum Recommended AC Line Fuses are shown in tables 1-1, 1-2 and 1-3. Note that branch circuit breakers or disconnect switches can not respond fast enough to provide the level of protection that the drive components require.

2.6 Input Devices

WARNING

Hardwired Stop Circuit

The drive start/stop control circuitry includes solid-state components. If hazards due to accidental contact with moving machinery or unintentional flow of liquid, gas or solids exist, an additional hardwired stop circuit is required to remove AC line power to the drive. When AC power is removed, the motor will coast to a stop. Consequently, an auxiliary braking method may be required.

WARNING

Motor Starters

The PHOENIX Drive is intended to be controlled by control input signals that will start and stop the motor. A device that routinely disconnects then reapplies line power to the drive for the purpose of starting and stopping the motor is not recommended.

WARNING

Bypass Contactors

An incorrectly applied or installed bypass system can result in Drive damage or reduction in product life. The most common mistakes are:

- Wiring the AC line to the Drive output or control terminals.
- Incorrect bypass or output circuits.
- Output circuits that do not directly connect to the motor.

2.7 ELECTRICAL INTERFERENCE (EMI/RFI)

2.7.1 Drive Immunity

The immunity of the PHOENIX Drives to externally generated interference is outstanding. No special precautions other than following the procedures outlined in this manual are required.

It is recommended that the coils of AC and DC energized contactors interfaced with the drives be suppressed with RC networks and diodes respectively or with similar devices. This is because non-suppressed coils (inductors) can generate high electrical transients.

In areas prone to frequent lightning strikes, the standard MOV's (Metal Oxide Varistors) supplied with the drive may need to be supplemented with additional surge suppression MOV's on the AC line feeding the drive.

2.7.2 Drive Emissions

Care must be used in the routing of power and ground connections to the drive to avoid interference with sensitive equipment that may be nearby. The cable from the drive to the motor carries switched voltages and should be routed well clear of sensitive equipment. The ground conductor of the motor cable should be connected to the drive ground stud directly. Connecting this ground conductor to a cabinet ground point or ground bus bar may cause high frequency current to circulate in the ground system of the drive enclosure. The motor end of this ground conductor must be solidly connected to the motor case ground. See Figure 2-3.

Shielded or armored cable may be used to minimize radiated emissions from the motor cable. The shield or armor should be connected to the drive ground stud and to the motor ground as shown in Figure 2-3.

2.8 GROUNDING

Refer to the "Recommended Power Wiring" diagram in figure 2-3 for grounding instructions. The drive must be connected to AC system ground using the **power ground stud(s)** provided near the input and output power terminal blocks. All drives provide a separate power ground stud or terminal point for both the input AC power terminal blocks (L1, L2 and L3) and the output to motor terminal blocks (U, V, and W). Ground impedance must conform to requirements of national and local industrial codes (NEC, VDE 0160, BSI, etc.) and should be inspected and tested at regular intervals.

The outgoing motor cable ground wire connects directly to the power ground stud as well as incoming AC line system ground wire. **These ground wires must have a current rating in compliance with the above mentioned national and local codes**. This results in the motor frame ground to be solidly connected through the drive chassis to the AC system ground.

Note that the drive signal common **(COM)** should **not** be connected to the **power ground stud** directly. If desired, **one** of these commons may be connected to **earth ground** at a single point outside the drive enclosure – see section 2.8.3 for more details.

For multiple drive systems, if the signal common on each drive is to be grounded, they can be "daisy-chained" connected, using a single **COM** point on each drive. Note that this drive **COM** "bus" should only tie to **earth ground** at only one point.

2.8.1 Grounding Sensitive Circuits

It is critical to control the paths through which high frequency ground currents flow. Sensitive circuits should not share a path with such currents. Control and signal conductors should not be run near or parallel to power conductors.

2.8.2 Motor Cable Grounding

The ground conductor of the motor cable (drive end) must be connected to the **power ground stud** provided near the U, V and W output to motor terminals. Grounding directly to drive provides a direct path for high frequency current returning from the motor frame and ground conductor. At the motor end, the ground conductor should also be connected to the motor case ground. See Figure 2-3.

If armored or shielded cables are used, the armor/shield should be grounded at both ends per figure 2-3.

2.8.3 Control Logic and Signal Grounding

The control logic and signal wiring for the PHOENIX Drive is shown in Figure 2-5. If the control wires are short, and contained within a cabinet that has no sensitive circuits, the use of shielded control wiring is not necessary. For all configurations, it is strongly suggested that shielded wire be used for the signal wiring.

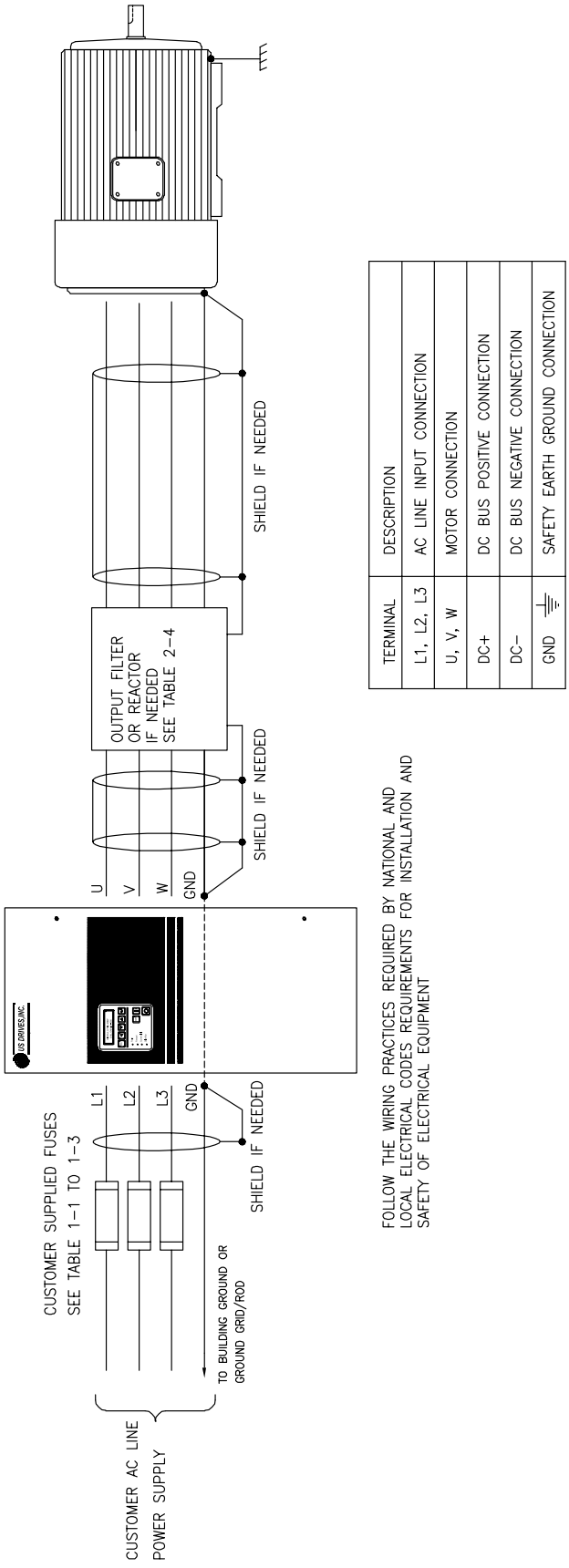


Figure 2-3
Recommended Power Wiring

2.9 Power Cabling

Input and Output power connections are made through the power terminal block and power ground stud. The actual drive label markings are shown in Table 2-1. Maximum torque values for terminal connections are also indicated on labels next to the connection points.

Table 2-1
Power Signal Description

Terminal	Description
GND	Power Earth Ground Stud
L1 L2 L3 AC LINE INPUT	AC Line Input Terminals
DC- DC+	DC Bus Terminals
U V W OUTPUT TO MOTOR	Motor Connection

2.9.1 Motor Cables

There are a wide variety of cable types that are acceptable for drive installations. For many installations, unshielded motor cable is acceptable, providing that it can be separated from sensitive circuits. A good rule of thumb to use is to allow a spacing of one foot (0.3 meters) for every 33 feet (10 meters) of length. For all situations, long parallel runs must be avoided. Conform to requirements of national and local industrial codes (NEC, VDE 0160, BSI, etc.) when selecting the type and size of the motor cable.

The cable should be 4-conductor with the ground being connected directly to the drive power ground and the motor frame ground terminal.

2.9.1.1 Shielded Motor Cable

If the separation suggested in section 2.9.1 above cannot be maintained or if sensitive circuits or devices are mounted or connected to machinery driven by the motor, shielded motor cable is recommended. The shield must be connected to ground at both ends to minimize interference. At the motor end, the motor cable shield should be tied to the motor frame ground and the drive end, to the power ground stud or ground terminal.

Shielded cable is also recommended for multiple drive installations where cable trays or large conduits are to be used to route motor leads from more than one drive. The shielded cable reduces the emission and capture (cross coupling) of noise between the motor leads of different drives. The cable shield connected to ground at both the drive end and the motor end.

Armored cable can also be used effectively to shield the motor leads. If possible, it should only be grounded at the drive end and to the motor frame at the motor end. With PVC coated armored cable, if the armored cable is grounded at a user supplied cabinet entrance, shielded cable should be used within the cabinet if the power leads will run to close to control or signal wiring.

2.9.1.2 Conduit for Routing Motor Cables

If metal conduit is to be used for motor cable distribution, the following procedures must be adhered to.

- When drives are mounted in user supplied cabinets, ground connections should be made to a common point in the cabinet. When conduit is used, it is normally grounded at the motor frame ground (junction box) and the cabinet ground.

  This helps reduce noise emissions from the drive. Please note that this recommendation is strictly for noise reduction and does not concern safety grounding requirements which are dictated by national and local codes. See section 2.1 (SAFETY WARNINGS) for details.

- If possible, each conduit should contain only one set of motor leads to minimize “cross talk” between drives which degrades the noise suppression techniques described above. If this is not practical, under no conditions should more than three sets of motor leads be installed in a common conduit. If more than three sets of motor leads are to be run in a common conduit, shielded cable must be used as described above.

2.9.1.3 Motor Lead Lengths

Installations with long motor cables may require the addition of an output reactor, a *dv/dt* filter or a carrier suppression filter to limit voltage reflections that become additive at the motor. Refer to Table 2-4 for guidance in using various techniques to limit the voltage reflections.

2.10 Control and Signal Wiring

Terminal blocks TB1 through TB4 on the drive main control board are used for connecting control and signal wiring to the PHOENIX drive. See Figure 2-4

for terminal block physical location and Figure 2-5 for terminal point connections. A brief summary of the terminal block assignments are shown in Table 2-3.

Table 2-3
Drive Main Control Board Terminal Block Layout

TERMINAL BLOCK	DESCRIPTION
TB1	Programmable Output Contacts
TB2	Control Logic Inputs (start, stop, jog, etc.)
TB3	Programmable Analog Outputs
TB4	Analog Reference Inputs (speed refs., PID setpoints, etc.)

Before proceeding with any signal wiring, the following precautions for the signal conduit and wire must be followed:

2.10.1 Signal Conduit Requirements

- Use either rigid steel or flexible armored steel cable.
- The signal conduit must cross non-signal conduit at an angle of between 45° and 90°.
- Do not route the conduit through junction or terminal boxes that have non-signal wiring.

2.10.2 Signal Wire Requirements

- Size and install all wiring in conformance with the requirements of national and local industrial safety regulations (NEC, VDE 0160, BSI, etc.)
- Use shielded wire for reference and other signal wire connections.
- Route all signal wiring away from high current lines such as AC lines.
- Always run the signal wire in steel conduit. Never run the signal wire with non-signal wire.
- Route external wiring, rated at 600 volts or more, in separate steel conduit to eliminate electrical noise pickup.
- For distances less than 150 feet, use a minimum of #22AWG wire. For distances more than 150 feet and less than 1000 feet, use a minimum of #16AWG wire.

CAUTION

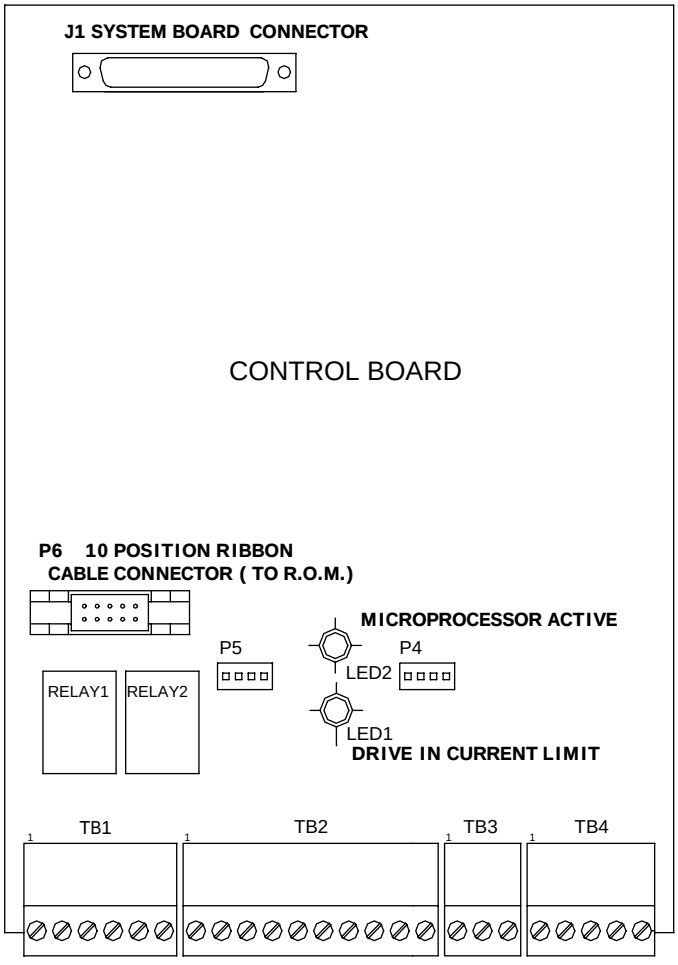
User installed control and signal wiring must be routed inside the drive enclosure such that it is separated from any other wiring and uninsulated live parts. Failure to observe this precaution can result in equipment damage.

Table 2-4
Maximum Recommended Motor Cable Lengths

Type of Termination at Drive	Maximum Cable Length With General Purpose Motor Feet [Meters]	Maximum Cable Length With "Definite Purpose Inverter-Fed Motor"[1] Feet [meters]
None	100 [30]	400 [120]
3 % Reactor at Drive[2]	300 [90]	600[180]
dv/dt Filter at Drive[3]	1000 [300]	3000 [915]]
Carrier Suppression Filter[4]	10 Miles [16 Kilometers]	10 Miles [16 Kilometers]

[1] "Definite Purpose Inverter-Fed Motor" as defined in NEMA MG1- Part 31 section 31.40.4.2 "*Voltage Spikes".*
[2] Reactor designed for Inverter output installation.
[3] *dv/dt* Filters available from *US Drives.*
[4] Carrier Suppression Filters available from *US Drives*. A Step-up-Transformer and/or oversized motor cables must be used when long wire run is required.

Figure 2-4
Terminal Block Locations for Drive Control Board



TB1-TB4 CONNECTION DATA:
MAXIMUM TORQUE: 5Lb-in [0.6 N-m]
WIRE SIZE: AWG 26-16 [0.14-1.5 mm]

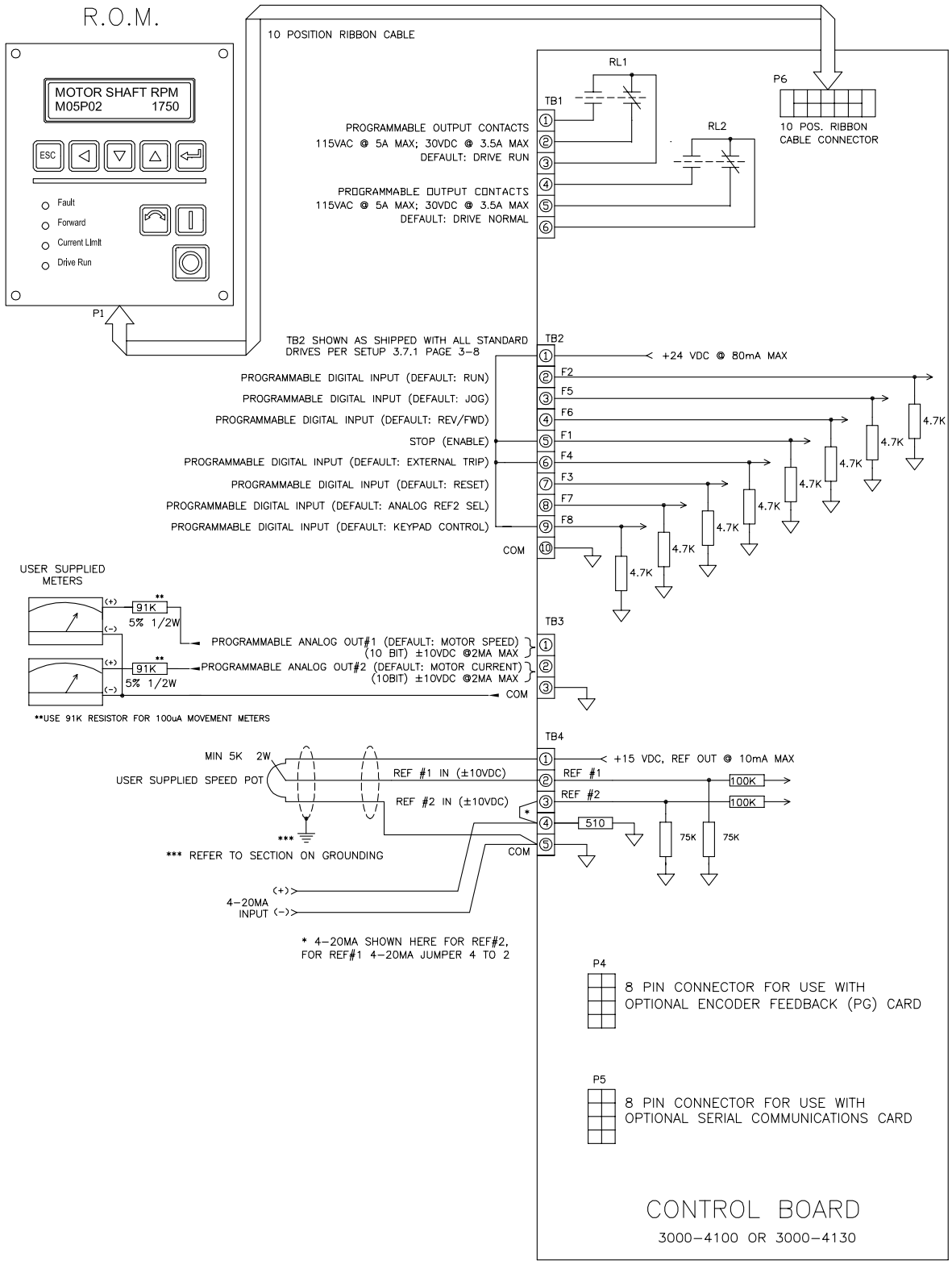


Figure 2-5
Control Logic and Signal Wiring

3.0 REAL-TIME OPERATOR MODULE

3.1 ROM DESCRIPTION

This section gives a brief description of the various controls and indicators on the Real-time Operator Module (ROM). The material presented here must be understood before the user proceeds to the "Quick Setup" section.

The ROM, in its standard configuration, is mounted to the enclosure door. For applications where the drive is mounted in another enclosure (e.g. – NEMA 12), the ROM can be remotely mounted as far as forty feet from the control board.

The ROM can be viewed as having two sections; a Display Panel and a Control Panel. The Display Panel provides access to program and to view the various Drive parameters. The Control Panel allows various drive functions to be controlled such as starting and stopping as well as displaying the drive status.

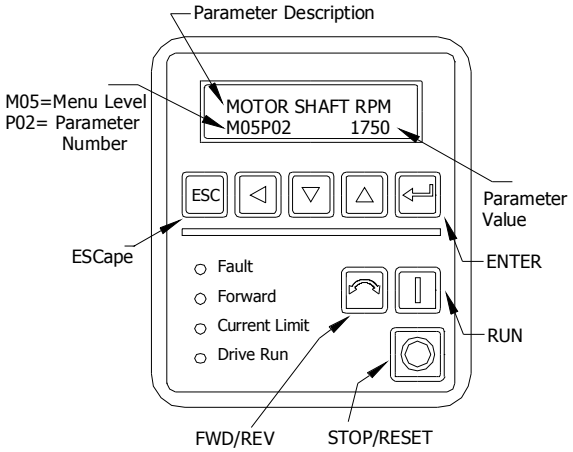


Figure 3-1
ROM Front Panel

3.2 DISPLAY PANEL KEY DESCRIPTIONS:

Escape
When pressed, the Escape key will abort the editing of a given parameter (restoring the original value if the parameter is R/W) if in the edit mode.

Enter
Pressing the enter key while on a menu item line, a flashing cursor will be displayed indicating a parameter value is ready for editing. After editing a parameter, pressing the enter key will cause the flashing cursor to go away and the value displayed is entered into memory.

Up/Down Arrow Keys
These keys are used to move up and down the menu level or to increment or decrement the parameter value.

Also simultaneous activation of both the Up and Down arrow keys quickly displays keypad reference parameter M01P04 for "Motor Operated Potentiometer" (MOP) mode. The MOP mode allows Keypad Reference to be increased or decreased by use of the Up and Down arrow keys. Pressing the enter key, the display will revert to the power-up display.

Left Arrow Key
Pressing the left arrow key when in the menu/parameter scrolling mode moves the flashing cursor from menu level to parameter number and vise versa, the up or down arrow keys can be used to change the menu level or the parameter number.
Pressing the left arrow key when in edit mode moves the flashing cursor left to the next decade of the parameter value to be increased or decreased by the up or down arrow keys respectively. When reaching the extreme left travel, further pressing of the left arrow key "wraps" to extreme right decade position.

3.3 CONTROL PANEL KEY AND LED DESCRIPTIONS:

Run
The Run key will start the drive if no other Stop commands are present and the keypad is enabled.

Stop/Reset
If the drive is running, pressing the Stop/Reset key will cause the drive to stop if the keypad is enabled.

If the drive has stopped due to a fault, pressing the Stop/Reset key will clear the fault and reset the drive.

Fwd/Rev
This key has the function of Forward and Reverse command.

Fault LED
The Fault LED becomes lit upon generation any fault and remains lit until the drive is reset either by way of the Stop/Reset key or a terminal block reset button. Simultaneous with the illumination of the Fault LED the appropriate Fault message is put out on the display. A blinking fault LED indicates that motor current is greater than 105% of the programmed motor rated

current. If the current is not reduced, the drive will trip on IxT overload after a period of time that depends on the extent of the overload. See Section 4-2 parameter M10B07 definition.

NOTE

Pressing any Display Panel key will clear the fault message allowing normal use of the display. However, until the drive is reset, the fault remains uncleared and the Fault LED will remain lit.

Forward LED

The Forward LED becomes lit upon command for the drive to run in the forward direction. This may be achieved by the FWD/REV key or from a terminal block input. When this LED is not lit, the drive is being commanded to run in the reverse direction.

Current Limit LED

This LED is lit whenever the drive is in current limit.

Drive Run LED

This LED indicates when the drive is running.

3.4 LIST OF PARAMETERS

3.4.1 Values and Character Strings

For parameters containing character strings, the following lists give the character strings as well as their numeric equivalents. When these parameters are accessed using serial communications, the numeric equivalents are used.

NOTE

Some parameters have alternative default values for certain versions of drive.

3.4.2 List of Menus

M00 Quick Setup & Quick Metering Menu
M01 Frequency reference selection, limits and filters
M02 Ramps
M03 Encoder
M04 Current limits and torque control
M05 Motor control

M06 Operational modes
M07 Analog inputs and outputs
M08 Digital inputs
M09 Digital outputs & bit selectors
M10 Status logic and diagnostic information
M11 Miscellaneous
M12 Programmable thresholds and variable selectors
M13 Timer functions
M14 PID control loop
M15 Position control
M17 2nd Motor Parameters

Menu display names:

M00 QUICK SETUP MENU
M01 FREQ REFS MENU
M02 RAMPS MENU
M03 ENCODER MENU
M04 CURR-TORQUE CTRL
M05 MOTOR CONTROL
M06 OPERATION MODES
M07 ANALOG I/O MENU
M08 DIG INS-MODE SEL
M09 DIG OUTS-BIT SEL
M10 STATUS-DIAGNOSTIC
M11 MISCELLANEOUS
M12 THRESHOLDS-VARSEL
M13 TIMERS FUNCTIONS
M14 PID CONTROL LOOP
M15 POSITION CONTROL
M17 2ND MOTOR PARAMS

3.4.3 Quick Setup menu List

The Quick Setup menu contains only the most commonly used parameters

Quick Setup Menu:
(Program Type parameters):

RATED MOTOR VOLT - M00P01
BASE MOTOR FREQ - M00P02
RATED MOTOR CURR - M00P03
NUMBER OF POLES - M00P04
SYM CURRENT LIM - M00P05
ACCEL RAMP - M00P06
DECEL RAMP - M00P07
MAX FREQUENCY - M00P08
MINIMUM FREQ - M00P09
RATED LINE VOLTS - M00P10

Quick Setup Menu:
(Metering Type parameters)

SOFTWARE VERSION - M00P11
DRIVE MODEL NO - M00P12
MOTOR VOLTAGE - M00P13

MOTOR POWER - M00P14
DC BUS VOLTAGE - M00P15
AC LINE VOLTAGE - M00P16
LAST FAULT - M00P17
MOT CURR-TOTAL - M00P18

FINAL FREQ REF - M00P19
MOTOR SHAFT RPM - M00P20

3.4.4 Parameter Attribute

Parameter changing and saving

New values given to parameters become effective immediately and are saved into eeprom.

Read-write and read-only parameters

Read-write parameters are shown as R-W; read-only parameters are shown as RO.

Default values

Default values displayed on the drive are given in the Default column in Parameter Definitions 4.2.

3.4.5 Menu Structure

The drive is programmed by entering values into parameters. The parameters are held in menus that group the parameters according to their functions.

The first menu is Menu 0 which is the Quick Setup Menu. This contains the basic parameters that may be read or adjusted for simple applications

The remaining menus are the advanced Menus. These contain all the parameters that may be read or adjusted for advanced applications.

The parameters in Menu 0 (M00) are duplicates of certain parameters in the advanced menus; for example, parameter M00P10 is a duplicate of M05P33 (Rated line volts). This menu is also user programmable. A user can define and create a menu using other parameters, for details refer to parameters M11P01 – M11P20.

3.4.6 Types of parameters

There are two types of parameter, as follows:

Bit parameters

Bit parameters can be set in either of two logic states and are used as on/off or change-over switches.

Bit parameters are prefixed with the letter B (e.g. – M01B11)

Variable Parameters

Variable parameters can be set at a value within a specified range. They are used to set numerical values, or to set the positions of switches having more than two options. Variable parameters are prefixed with the letter P (e.g. –M01P25)

Certain parameters contain character strings instead of numerical values. The character strings are displayed on the Control Keypad in place of values. When these parameters are accessed and edited using serial communications, a numerical equivalent is displayed on the host computer. The numerical equivalent is used for programming these parameters.

3.4.7 Restore All Parameters to Factory Default Values

To restore all parameters to factory default value

1. Make sure the drive is disabled and that the motor is not being driven.
2. Select parameter M11P36 "FACTORY DEFAULTS".
3. Select "YES".
4. Press the enter key.
5. The default values are entered into all the parameters.

3.4.8 Security Code

A security code can be set to prevent unauthorized personnel from making changes to the drive parameters via the keypad. There are two states, "locked state" and "unlocked state". In the "locked state" only R/O (read only) parameters can be viewed except of course entering the access code (M11P37). In the "unlocked state", the user can view and edit any parameter.

The drive is shipped defaulted "unlocked" where all parameters are accessible and be can edited by the user. The user programmable security code (parameter M11P29 "SECURITY CODE") is shipped defaulted to 0, so that on every power-up, the drive is always "unlocked".

To change to "locked state" where no parameter editing is allowed, you must change security code parameter M11P29 "SECURITY CODE" from 0 to any number up to 4 digits (be sure to remember this number because your access code must match this number to "unlock" the drive). Right after you change the security code, you must go to parameter M11P37 "ACCESS CODE" and reenter 0 to "lock" the drive. To go back to the "unlocked state" you must enter your access code into parameter M11P37 "ACCESS CODE", the drive will stay in "unlocked state" until you power down the drive or change parameter M11P37 "ACCESS CODE".

Use Parameter M11P44 to disable or enable editing of parameters via serial communications.
Serial communications can be used to unlock the drive using your access code into parameter M11P37 to gain

access to M11P44. Note that when the drive is unlocked full access via keypad is available. To prevent this you can lock the drive again after you made your changes to M11P44.

3.5 START UP AND QUICK SETUP

The "Factory Default" settings for the drive have been purposely setup to make the "Start-Up and Quick Setup" as simple as possible. Even for advanced users, going through this procedure is a quick and simple way to verify proper drive operation and it provides a good starting platform for more advanced setups.

This Start-Up and Quick Setup procedure covers only the most commonly adjusted parameters, all of which appear in the quick setup menu 0.

WARNING

THE FOLLOWING PROCEDURES SHOULD ONLY BE PERFORMED AFTER A COMPLETE REVIEW OF THE INSTALLATION SECTION OF THIS MANUAL. THIS SECTION CONTAINS WARNINGS, INITIAL CHECKS, WIRING INSTRUCTIONS AND OTHER INFORMATION CRITICAL TO THE SUCCESSFUL STARTUP OF THE DRIVE. PAY PARTICULAR ATTENTION TO THE "WARNING" AND "CAUTION" NOTES.

Power must be applied to the drive to perform the following procedure. Some of the voltages present are at the incoming line potential. To avoid electric shock hazard or damage to equipment, only qualified service personnel should perform the following procedure. Thoroughly read and understand the procedure before beginning. If an event does not occur while performing this procedure, **Do Not Proceed. Remove Power** by opening the branch circuit disconnect device and correct the malfunction before continuing.

NOTE

Power must be applied to the drive when viewing or changing Phoenix parameters. Previous programming may affect the drive status when power is applied. If the state of the parameters is in question, load factory defaults as detailed in section 3.4.7, "Drive Programming" before proceeding.
Remote start circuits may be connected to TB2 of the control board. Confirm that all circuits are in a de-energized state before applying power. User supplied voltages may exist at TB2, even when power is not applied to the drive.
Refer to section 4.0, for fault message information.

The following procedure describes starting and stopping the drive using the ROM Run and Stop keys. The drive frequency reference is from the ROM Keypad reference parameter M01P04.

3.6 START-UP PROCEDURE FOR RUNNING DRIVE WITH ROM "KEYPAD":

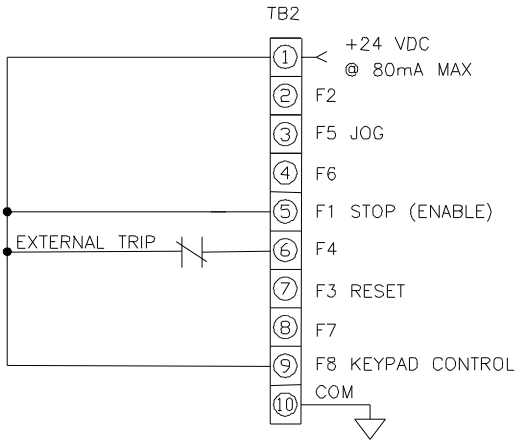
3.6.1 Wiring Checks – Motor Disconnected:

1. Verify that AC line power at the disconnect device is within the rated value of the drive. If a control interface option is installed, verify that the control power to this board matches the board rating.

2. Remove and lock-out all incoming power to the drive including incoming AC power to terminals L1, L2 and L3 plus any separate control power for remote interface devices. Open the drive door and disconnect the motor leads from terminals U, V and W.

3. Verify that the "Stop", "External Fault" and "keypad enable" interlocks are installed. If not, connect jumpers between TB2-1, TB2-5, TB2-6 and TB2-9 as shown in Figure 3-1 below

Figure 3-2
Control Wiring for Keypad Operation



4. Check for earth ground faults with an ohmmeter. A very high resistance of over 1 mega-ohm should be measured from earth ground to all terminals. If there is a low reading, investigate before proceeding. If all readings are high, then power can be applied.

5. Apply AC power and control voltages to the drive.

3.6.2 Drive Programming:

1. On power-up, the LCD Display should light and show the default Powerup Display. Press the Escape key and then the Left arrow key and you see a flashing cursor on the menu level. Press the Up/Down Arrow keys until you see the M00PXX menu 0. Press Left arrow key until you see a flashing cursor on the parameter number. You are now ready to edit the following parameters if necessary.

2. Use the UP/Down Arrow key to view each parameter listed below and observe its value. If you like what you see, go on to the next parameter. If you want to change the value of a parameter, press the Enter key and using the Left and Up/Down Arrow keys to get the value you want. Accept the parameter value by hitting the Enter key, then proceed to the next parameter. The following parameters are found under the Quick Setup menu:

   Quick Setup Menu (Program Type):

RATED MOTOR VOLT	- M00P01
BASE MOTOR FREQ	- M00P02
RATED MOTOR CURR	- M00P03
NUMBER OF POLES	- M00P04
SYM CURRENT LIM	- M00P05
ACCEL RAMP	- M00P06
DECEL RAMP	- M00P07
MAX FREQUENCY	- M00P08
MINIMUM FREQ	- M00P09
RATED LINE VOLTS	- M00P10

3.6.3 Remove Power

Remove and lock-out the input and control power to the drive. When the ROM Display is no longer illuminated, open the drive door.

WARNING

TO AVOID A HAZARD OF ELECTRIC SHOCK, AFTER THE INPUT AND CONTROL POWER IS REMOVED FROM THE DRIVE AND THE ROM DISPLAY IS NO LONGER LIT, WAIT FIVE (5) MINUTES FOR BUS CAPACITORS TO FULLY DISCHARGE.

3.6.4 Reconnect Motor:

WARNING

In the following steps, rotation of the motor in an undesired direction can occur. To guard against possible equipment damage, it is recommended that the motor be disconnected from the load before proceeding.

1. Reconnect motor leads and close drive door.

3.6.5 Check for Correct Motor Rotation:

1. Reapply power to the drive

2. Verify that the drive reference frequency is at zero Hz.

   For Keypad frequency reference control, press the Up arrow and Down arrow keypad keys simultaneously to quickly access the keypad reference parameter M01P04. Simply then use the Display Panel Left Arrow key to select the desired decade and the Down Arrow key to decrease the parameter value to zero. When finished adjusting speed, pressing the Enter.

3. Using the Forward LED on the ROM Display Panel verify that the forward direction is selected. (LED should be illuminated).

4. Start the drive using the ROM Run key. Slowly increase the drive speed until the motor begins to turn. Note the direction of motor rotation, then stop the drive using the ROM Stop key. If the direction of rotation is correct, proceed on to section 3.6.6, "Check for Proper Operation".

   If the direction of motor rotation is incorrect, remove and lock-out input and control power to the drive. When the ROM is no longer illuminated, wait for five (5) minutes for the bus capacitors to fully discharge. Open drive door and interchange any two of the three motor leads, U, V, or W. Close drive door and repeat steps 2 through 5 to verify correct rotation.

3.6.6 Check for Proper Operation:

1. Start the drive and slowly increase the frequency reference. Check for proper motor operation throughout the speed range.

2. With the drive running at 10 Hz or greater, press the ROM Stop key and verify that the correct stopping mode has been programmed.

3. This completes the "Startup and Quick Setup" procedure. Depending on your application, further parameter programming may be required. Refer to the Programming section of this manual for more information.

   That's all there is to it! Remember; use the Run and Stop Display Panel keys to control the drive.

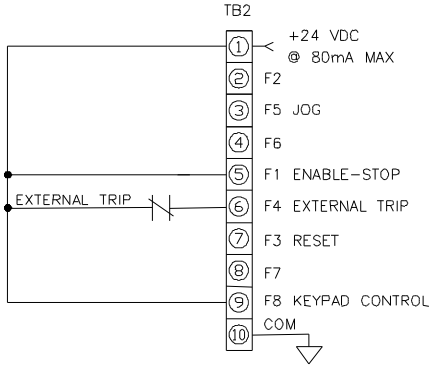
   Remember, you can use the following Quick Metering Menu to verify and view motor current, speed, and other display parameters.

SOFTWARE VERSION	- M00P11
DRIVE MODEL NO	- M00P12
MOTOR VOLTAGE	- M00P13
MOTOR POWER	- M00P14
DC BUS VOLTAGE	- M00P15
AC LINE VOLTAGE	- M00P16
LAST FAULT	- M00P17
MOT CURR-TOTAL	- M00P18
FINAL FREQ REF	- M00P19
MOTOR SHAFT RPM	- M00P20

3.7 TYPICAL CONTROL SETUPS

Starting point for all setups described below are from factory default setup shipped with all standard drives.

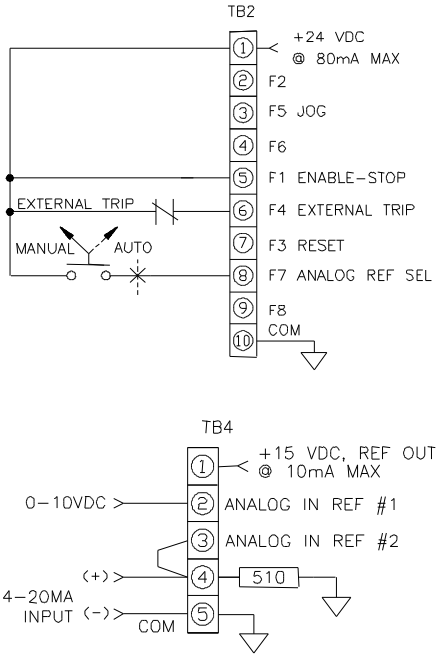
3.7.1 Keypad Mode (Keypad Start/Stop & Keypad Reference)



***NOTE**: Reverse function is disabled. If FWD/REV is needed set M06B23 (DISABLE REV ROT) to 0 and M06P18 (KEYPAD CONT MODE) to "ALL KEYS".

Start command: Keypad RUN key.
Stop command: Keypad STOP key.
* FWD/REV command: Keypad FWD/REV key.
Jog command: JOG contact at TB2-3-TB2-1.
Reset command: keypad STOP/RESET key or pushbutton at TB2-7-TB2-1.
Speed reference source: Keypad reference M01P04.

3.7.2 Keypad Start/Stop with Analog Speed Reference



Change the following parameters in the order shown:
M06P18 (KEYPAD CONT MODE) ← NO KEYS
M06B15 (EN KEYPAD RUN) ← 1
M06B16 (KEYPAD STOP) ← 1
M06B17 (EN KEYPAD FWD/RV) ← 0

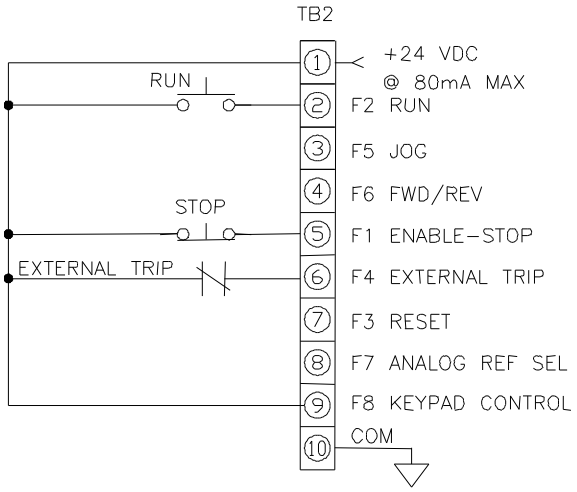
Manual Mode:
Start command: Keypad RUN key.
Stop command: Keypad STOP key.
* FWD/REV command: Keypad FWD/REV key.
Jog command: JOG contact at TB2-3-TB2-1.
Reset command: keypad STOP/RESET key or pushbutton at TB2-7-TB2-1.
Speed reference source: Analog reference 1, 0-10Vdc operation.

Auto Mode:
Start command: Keypad RUN key.
Stop command: Keypad STOP key.
* FWD/REV command: Keypad FWD/REV key.
Jog command: JOG contact at TB2-3-TB2-1.
Reset command: keypad STOP/RESET key or pushbutton at TB2-7-TB2-1.

Speed reference source: Analog reference 2, 4-20MA operation with min speed when loss of 4-20MA signal (refer to M07P13 for other choices).

***NOTE**: Reverse function is disabled. If FWD/REV is needed set M06B23 (DISABLE REV ROT) to 0 and M06B17 (EN KEYPAD FWD/RV) ← 1

3.7.2.a "3-Wire or "Momentary Contact" Control with Keypad Speed Reference

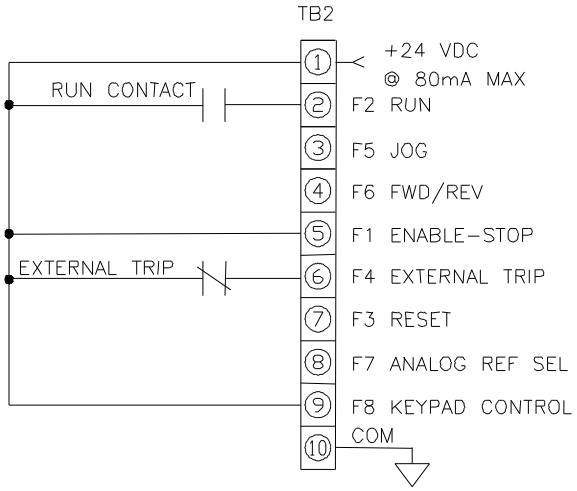


Change the following parameters in the order as shown:
M06P18 (KEYPAD CONT MODE) ← NO KEYS
M06B15 (EN KEYPAD RUN) ← 0
M06B16 (EN KEYPAD STOP) ← 0
M06B17 (EN KEYPAD FWD/RV) ← 0

Start command: RUN pushbutton at TB2-2-TB2-1.
Stop command: STOP pushbutton at TB2-5-TB2-1.
*FWD/REV command: Contact at TB2-4-TB2-1.
Jog command: JOG contact at TB2-3-TB2-1.
Reset command: keypad STOP/RESET key or pushbutton at TB2-7-TB2-1.
Speed reference source: Keypad reference M01P04.

***Note**: Reverse function is disabled. If FWD/REV function is needed set M06P23 (DISABLE REV ROT) to 0 to enable.

3.7.2.b "2-Wire or "Maintained Contact" Control with Keypad Speed Reference



Change the following parameters in the order as shown:
M06P07 (SEQUENCING MODE) ← 2-WIRE

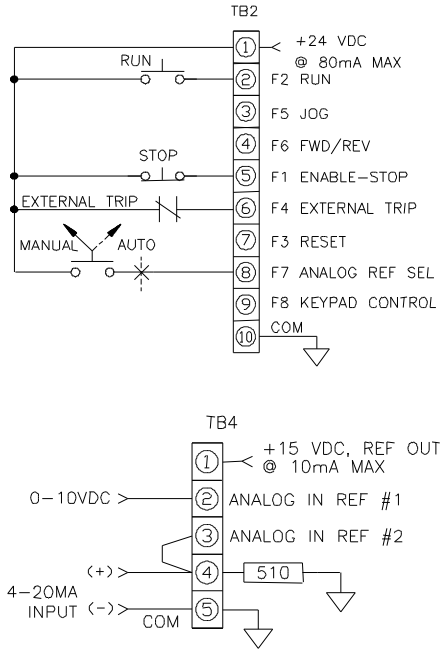
Note: If analog reference is desired for speed reference, disconnect TB2-9.

Keypad RUN, STOP and FWD/REV are not operational in this mode.

Start/Stop command: RUN contact at TB2-2-TB2-1.
*FWD/REV command: Contact at TB2-4-TB2-1.
Jog command: JOG contact at TB2-3-TB2-1.
Reset command: keypad STOP/RESET key or pushbutton at TB2-7-TB2-1.
Speed reference source: Keypad reference M01P04.

***Note**: Reverse function is disabled. If FWD/REV function is needed set M06P23 (DISABLE REV ROT) to 0 to enable.

3.7.3 "3-Wire or "Momentary Contact" Control



Manual Mode:

Start command: RUN pushbutton at TB2-2-TB2-1.
Stop command: STOP pushbutton at TB2-5-TB2-1.
* FWD/REV command: Contact at TB2-4-TB2-1.
Jog command: JOG contact at TB2-3-TB2-1.
Reset command: keypad STOP/RESET key or pushbutton at TB2-7-TB2-1.
Speed reference source: Analog reference 1, 0-10Vdc operation.

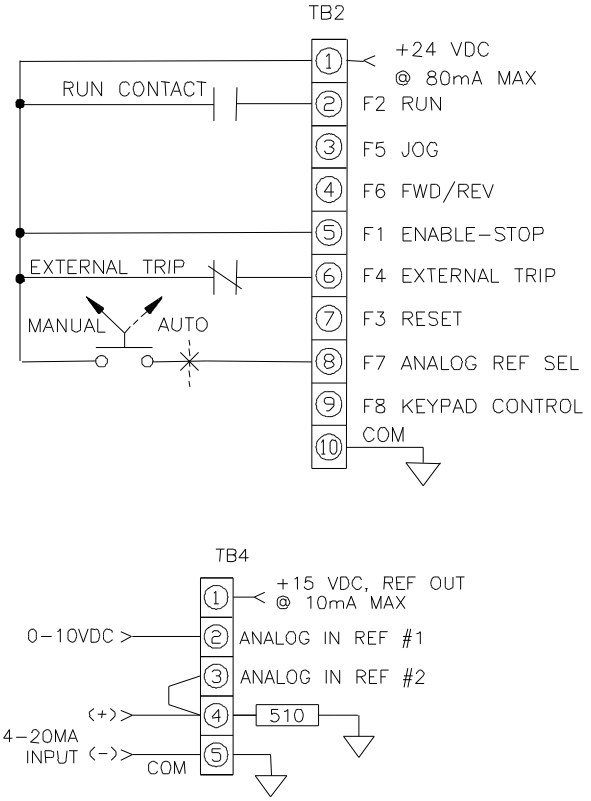
Auto Mode:

Start command: RUN pushbutton at TB2-2-TB2-1.
Stop command: STOP pushbutton at TB2-5-TB2-1.
* FWD/REV command: Contact at TB2-4-TB2-1.
Jog command: JOG contact at TB2-3-TB2-1.
Reset command: keypad STOP/RESET key or pushbutton at TB2-7-TB2-1.
Speed reference source: Analog reference 2, 4-20MA operation with min speed when loss of 4-20MA signal (refer to M07P13 description for other choices).

Note: If TB2-9 is wired to TB2-1, keypad control mode is enabled and the following has priority:
Start command: Keypad RUN key.
Stop command: Keypad STOP key.
FWD/REV command: Keypad USER key.
Jog command: JOG contact at TB2-3-TB2-1.
Reset command: keypad STOP/RESET key or pushbutton at TB2-7-TB2-1.
Speed reference source: Keypad reference M01P04.

***NOTE:** Reverse function is disabled. If FWD/REV is needed set M06B23 (DISABLE REV ROT) to 0 to enable.

3.7.4 "2-Wire" or "Maintained Contact" with Analog Speed Reference



Change the following parameters in the order as shown:
M06P07 (SEQUENCING MODE) ← 2-WIRE

Manual Mode:

Start/Stop command: RUN contact at TB2-2-TB2-1.
* FWD/REV command: Contact at TB2-4-TB2-1.
Jog command: JOG contact at TB2-3-TB2-1.
Reset command: keypad STOP/RESET key or pushbutton at TB2-7-TB2-1.
Speed reference source: Analog reference 1, 0-10Vdc operation.

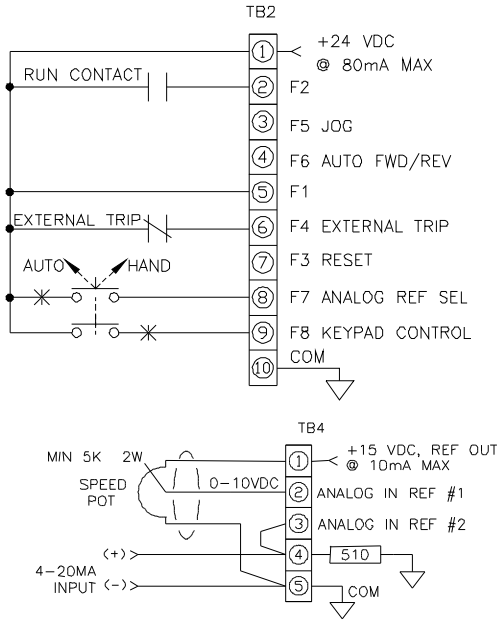
Auto Mode:

Start/Stop command: RUN contact at TB2-2-TB2-1.
* FWD/REV command: Contact at TB2-4-TB2-1.
Jog command: JOG contact at TB2-3-TB2-1.
Reset command: keypad STOP/RESET key or pushbutton at TB2-7-TB2-1.
Speed reference source: Analog reference 2, 4-20MA operation with min speed when loss of 4-20MA signal (refer to M07P13 description for other choices).

Note: If TB2-9 is wired to TB2-1, keypad speed reference is enabled M01P04.

***NOTE:** Reverse function is disabled. If FWD/REV is needed set M06B23 (DISABLE REV ROT) to 0 to enable.

3.7.5 HAND-AUTO with 2-Wire Control in Auto Mode



Change the following parameters in the order shown:

Part A Programming:
M06P18 (KEYPAD CONT MODE) ← NO KEYS
M06P15 (EN KEYPAD RUN) ← 1
M06B16 (EN KEYPAD STOP) ← 1
M08P21 (F8 INPUT DESTINA) ← 0.0
M01B08 (KEYPAD CONTROL) ← 0

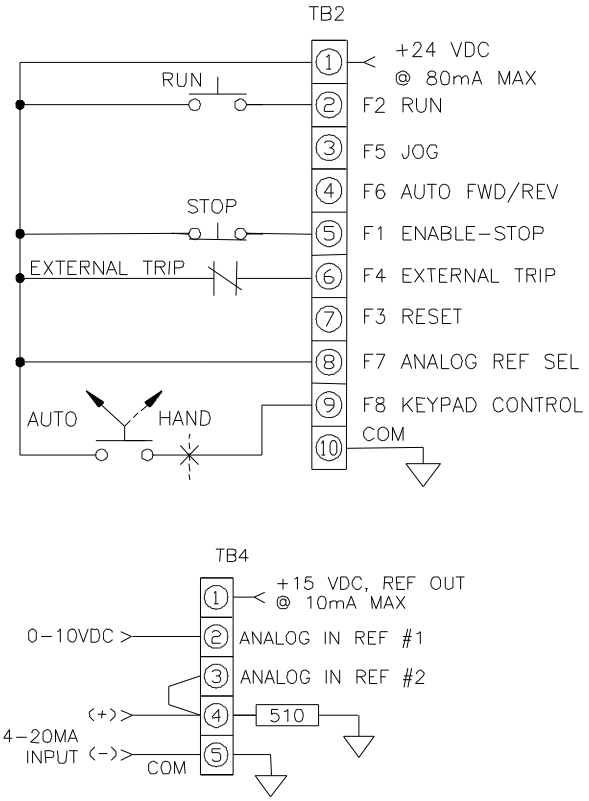
Part B Programming:
M08B23 (MODE SELECT SRC) ← 8.08 (Used to sense mode)
M08B24 (MODESEL OUT DEST) ← 6.07 (Used to switch 2 or 3 wire)
M08P26 (MODE SEL LOGIC 0) ← 3 (Select 2-Wire in AUTO Mode)
M08P27 (MODE SEL LOGIC 1) ← 0 (Select 3-Wire in Hand Mode)

Hand Mode:
Start command: Keypad RUN
Stop command: Keypad STOP
* FWD/REV command: Keypad FWD/REV key.
Jog command: JOG contact at TB2-3-TB2-1.
Reset command: keypad STOP/RESET key or pushbutton at TB2-7-TB2-1.
Speed reference source: Keypad reference M01P04
(With only Part B programming above)
Speed reference source: analog reference 1, 0-10V operation (speed potentiometer as shown above).
(With Part A and Part B programming above)

Auto Mode:
Start/Stop command: RUN contact at TB2-2-TB2-1
* FWD/REV command: Contact at TB2-4-TB2-1.
Reset command: keypad STOP/RESET key or pushbutton at TB2-7-TB2-1.
Speed reference source: Analog reference 2 is, 4-20MA operation with min speed when loss of 4-20MA signal (refer to M07P13 description for other choices).

***NOTE:** Reverse function is disabled. If FWD/REV is needed set M06B23 (DISABLE REV ROT) to 0 and set:
- M06P18 (KEYPAD CONT MODE) to "ALL KEYS" when HAND mode is Keypad reference M01P04 or
- M06B14 (KEYPAD FWD/REV) = 1 when HAND mode is analog reference 1 (speed potentiometer)

3.7.6 HAND-AUTO with 3-Wire Control in Auto Mode

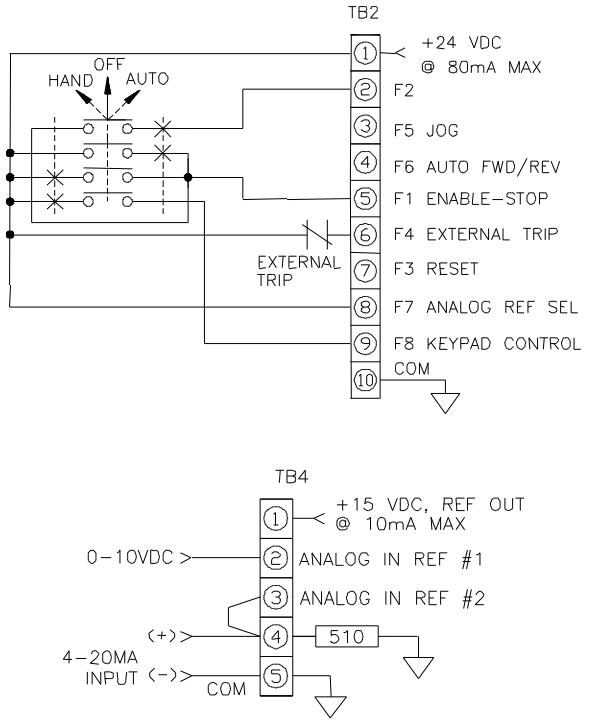


Hand Mode:
Start command: Keypad RUN key.
Stop command: Keypad STOP key.
* FWD/REV command: Keypad FWD/REV key.
Jog command: JOG contact at TB2-3-TB2-1.
Reset command: keypad STOP/RESET key or pushbutton at TB2-7-TB2-1.
Speed reference: Keypad reference M01P04.

Auto Mode:
Start command: RUN pushbutton at TB2-2-TB2-1.
Stop command: STOP pushbutton at TB2-5-TB2-1.
* FWD/REV command: Contact at TB2-4-TB2-1.
Jog command: JOG contact at TB2-3-TB2-1.
Reset command: keypad STOP/RESET key or pushbutton at TB2-7-TB2-1.
Speed reference source:
- When TB2-8 is wired to TB2-1, analog reference 2 is selected for AUTO reference, 4-20MA operation with min speed when loss of 4-20MA signal (refer to M07P13 description for other choices)
- When TB2-8 is not wired to TB2-1, analog reference 1 is selected for AUTO reference, 0-10Vdc.

***NOTE:** Reverse function is disabled. If FWD/REV is needed set M06B23 (DISABLE REV ROT) to 0 and M06P18 (KEYPAD CONT MODE) to "ALL KEYS".

3.7.7 HAND-OFF-AUTO #1A Control

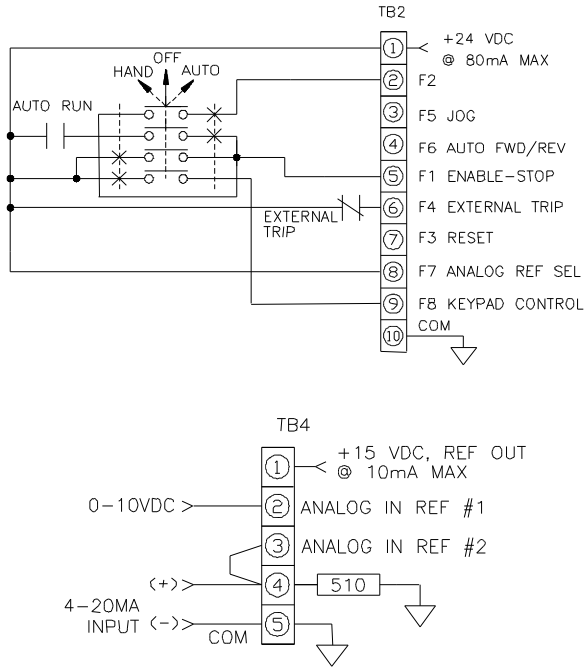


Hand Mode:
Start command: Keypad RUN
Stop command: Keypad STOP
* FWD/REV command: Keypad FWD/REV key.
Jog command: JOG contact at TB2-3-TB2-1.
Reset command: keypad STOP/RESET key or pushbutton at TB2-7-TB2-1.
Speed reference source: Keypad reference M01P04

Auto Mode:
Start/Stop command: Drive starts when HOA switch is thrown to AUTO.
* FWD/REV command: Contact at TB2-4-TB2-1.
Reset command: keypad STOP/RESET key or pushbutton at TB2-7-TB2-1.
Speed reference source:
- When TB2-8 is wired to TB2-1, analog reference 2 is selected for AUTO reference, 4-20MA operation with min speed when loss of 4-20MA signal (refer to M07P13 description for other choices).
- When TB2-8 is not wired to TB2-1, analog reference 1 is selected for AUTO reference, 0-10V operation.

***NOTE:** Reverse function is disabled. If FWD/REV is needed set M06B23 (DISABLE REV ROT) to 0 and M06P18 (KEYPAD CONT MODE) to "ALL KEYS".

3.7.8 HAND-OFF-AUTO #2A Control

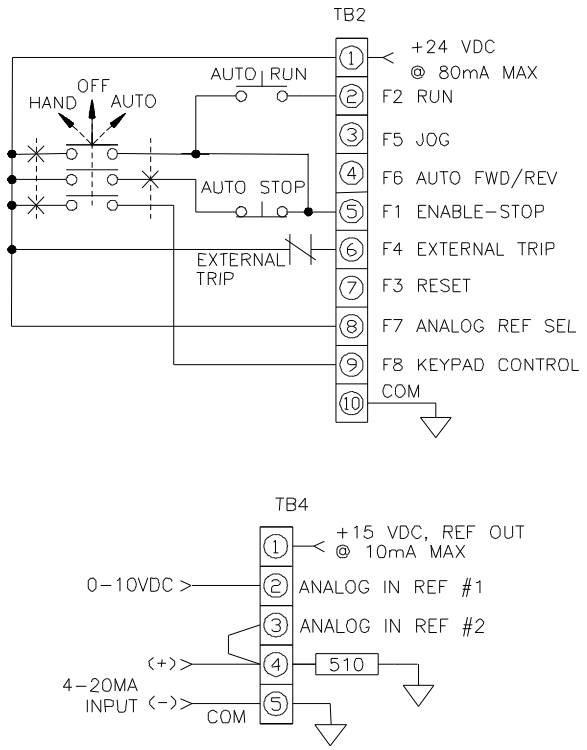


Hand Mode:
Start command: Keypad RUN key.
Stop command: Keypad STOP key.
* FWD/REV command: Keypad FWD/REV key.
Jog command: JOG contact at TB2-3-TB2-1.
Reset command: keypad STOP/RESET key or pushbutton at TB2-7-TB2-1.
Speed reference source: Keypad reference M01P04.

Auto Mode:
Start/Stop command: AUTO Run contact as wired above.
* FWD/REV command: Contact at TB2-4-TB2-1.
Reset command: keypad STOP/RESET key or pushbutton at TB2-7-TB2-1.
Speed reference source:
- When TB2-8 is wired to TB2-1, analog reference 2 is selected for AUTO reference, 4-20MA operation with min speed when loss of 4-20MA signal (refer to M07P13 description for other choices).
- When TB2-8 is not wired to TB2-1, analog reference 1 is selected for AUTO reference, 0-10Vdc operation.

***NOTE:** Reverse function is disabled. If FWD/REV is needed set M06B23 (DISABLE REV ROT) to 0 and M06P18 (KEYPAD CONT MODE) to "ALL KEYS".

3.7.9 HAND-OFF-AUTO #3A Control



Hand Mode:

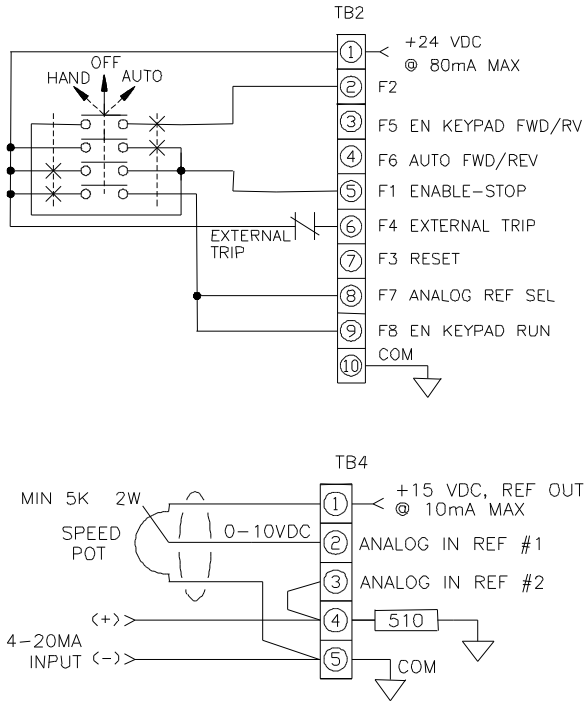
Start command: Keypad RUN key
Stop command: Keypad STOP key
* FWD/REV command: Keypad FWD/REV key.
Jog command: JOG contact at TB2-3-TB2-1.
Reset command: keypad STOP/RESET key or pushbutton at TB2-7-TB2-1.
Speed reference: Keypad reference M01P04

Auto Mode:

Start command: AUTO RUN pushbutton as wired above.
Stop command: AUTO STOP pushbutton as wired above.
* FWD/REV command: Contact at TB2-4-TB2-1.
Jog command: JOG contact at TB2-3-TB2-1.
Reset command: keypad STOP/RESET key or pushbutton at TB2-7-TB2-1.
Speed reference source:
- When TB2-8 is wired to TB2-1, analog reference 2 is selected for AUTO reference, 4-20MA operation with min speed when loss of 4-20MA signal (refer to M07P13 description for other choices)
- When TB2-8 is not wired to TB2-1, analog reference 1 is selected for AUTO reference, 0-10Vdc operation

***NOTE:** Reverse function is disabled. If FWD/REV is needed set M06B23 (DISABLE REV ROT) to 0 and M06P18(KEYPAD CONT MODE) to "ALL KEYS".

3.7.10 HAND-OFF-AUTO #1B Control



Change the following parameters in the order shown:

M08P21 (F8 INPUT DESTINA)	← 6.15 (M06B15)
M01B08 (KEYPAD CONTROL)	← 0
M06P18 (KEYPAD CONT MODE)	← NO KEYS
M06B16 (EN KEYPAD STOP)	← 1
M08P15 (F5 INPUT DESTINA)	← 6.17 (M06B17)
M08B20 (F7 INVERT)	← 1
M06B09 (SEQUENCING BIT1)	← 0

Hand Mode:

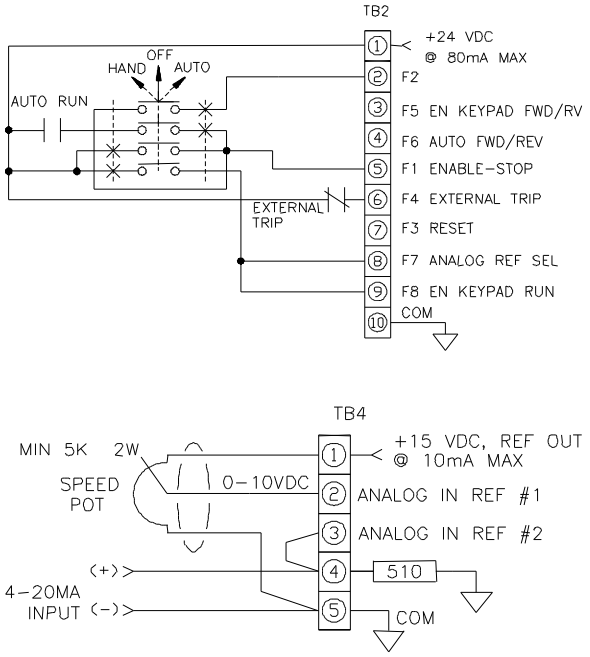
Start command: Keypad RUN
Stop command: Keypad STOP
* FWD/REV command: Keypad FWD/REV key.
Reset command: keypad STOP/RESET key or pushbutton at TB2-7-TB2-1.
Speed reference source: analog reference 1, 0-10V operation (speed potentiometer as shown above).

Auto Mode:

Start/Stop command: Drive starts when HOA switch is thrown to AUTO.
* FWD/REV command: Contact at TB2-4-TB2-1.
Reset command: keypad STOP/RESET key or pushbutton at TB2-7-TB2-1.
Speed reference source: analog reference 2, 4-20MA operation with min speed when loss of 4-20MA signal (refer to M07P13 description for other choices).

***NOTE:** Reverse function is disabled. If FWD/REV is needed set M06B23 (DISABLE REV ROT) to 0 and wire TB2-3 to TB2-9.

3.7.11 HAND-OFF-AUTO #2B Control



Change the following parameters in the order shown:

M08P21 (F8 INPUT DESTINA)	← 6.15 (M06B15)
M01B08 (KEYPAD CONTROL)	← 0
M06P18 (KEYPAD CONT MODE)	← NO KEYS
M06B16 (EN KEYPAD STOP)	← 1
M08P15 (F5 INPUT DESTINA)	← 6.17 (M06B17)
M08B20 (F7 INVERT)	← 1
M06B09 (SEQUENCING BIT1)	← 0

Hand Mode:

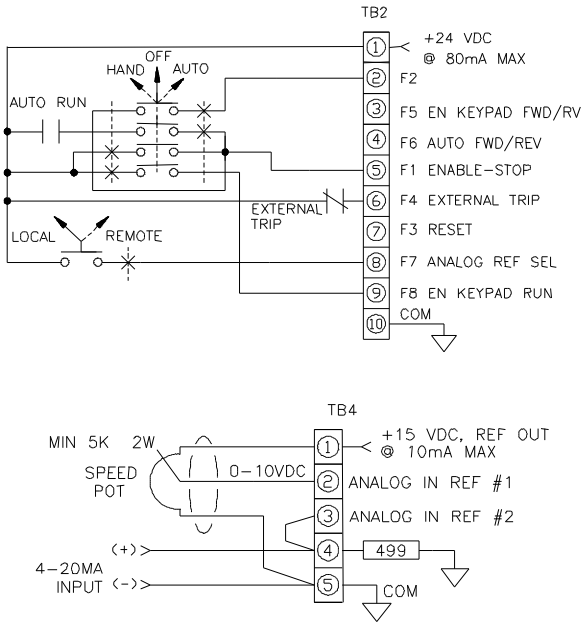
Start command: Keypad RUN key.
Stop command: Keypad STOP key.
* FWD/REV command: Keypad FWD/REV key.
Reset command: keypad STOP/RESET key or pushbutton at TB2-7-TB2-1.
Speed reference source: analog reference 1, 0-10Vdc operation (speed potentiometer as shown above).

Auto Mode:

Start/Stop command: AUTO Run contact as wired above.
* FWD/REV command: Contact at TB2-4-TB2-1.
Reset command: keypad STOP/RESET key or pushbutton at TB2-7-TB2-1.
Speed reference source: analog reference 2, 4-20MA operation with min speed when loss of 4-20MA signal (refer to M07P13 description for other choices).

***NOTE:** Reverse function is disabled. If FWD/REV is needed set M06B23 (DISABLE REV ROT) to 0 and wire TB2-3 to TB2-9.

3.7.11.a HAND-OFF-AUTO & LOCAL-REMOTE #2B.a



Change the following parameters in the order as shown:

M08P21 (F8 INPUT DESTINA)	← 6.15 (M06B15)
M01B08 (KEYPAD CONTROL)	← 0
M06P18 (KEYPAD CONT MODE)	← NO KEYS
M06B16 (EN KEYPAD STOP)	← 1
M08P15 (F5 INPUT DESTINA)	← 6.17 (M06B17)
M06B09 (SEQUENCING BIT1)	← 0

Hand Mode:

Start command: Keypad RUN key.
Stop command: Keypad STOP key.
*FWD/REV command: Keypad FWD/REV key.
Reset command: keypad STOP/RESET key or pushbutton at TB2-7-TB2-1.

Auto Mode:

Start/Stop command: AUTO Run contact as wired above.
*FWD/REV command: Contact at TB2-4-TB2-1.
Reset command: keypad STOP/RESET key or pushbutton at TB2-7-TB2-1.

Note: When the H-O-A switch is in the off position the drive stops regardless of the state of the Hand or Auto run commands.

Local Mode:

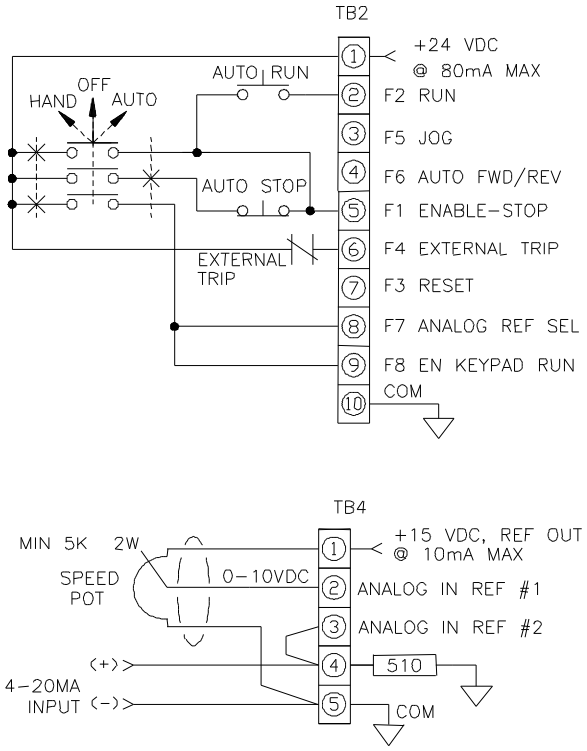
Speed reference source: analog reference 1, 0-10Vdc operation (speed potentiometer as shown above).

Remote Mode:

Speed reference source: analog reference 2, 4-20MA operation with min speed when loss of 4-20MA signal (refer to M07P13 description for other choices).

***NOTE**: Reverse function is disabled. If FWD/REV function is needed set M06P23 (DISABLE REV ROT) to 0 and wire TB2-3 to TB2-9.

3.7.12 HAND-OFF-AUTO #3B Control



Change the following parameters in the order shown:

M08P21 (F8 INPUT DESTINA)	← 6.15 (M06B15)
M01B08 (KEYPAD CONTROL)	← 0
M06P18 (KEYPAD CONT MODE)	← NO KEYS
M06B16 (EN KEYPAD STOP)	← 1
M08B20 (F7 INVERT)	← 1

Hand Mode:

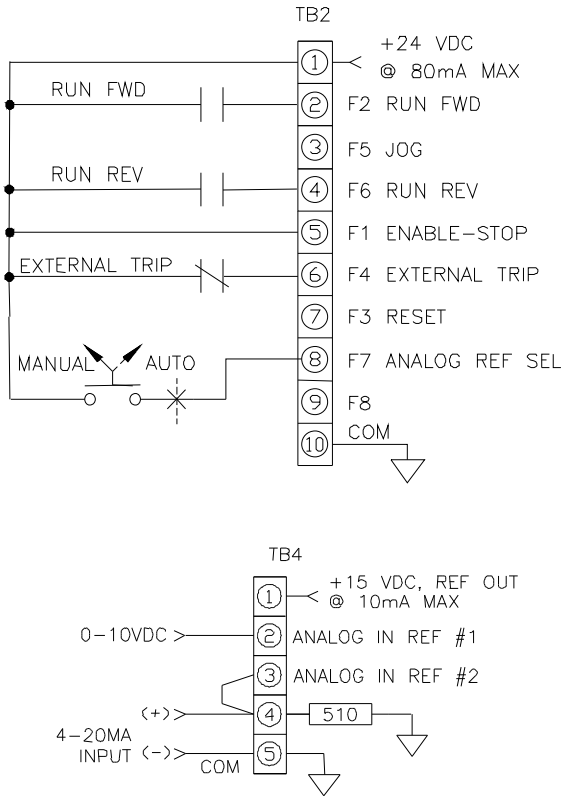
Start command: Keypad RUN key
Stop command: Keypad STOP key
Jog command: JOG contact at TB2-3-TB2-1.
Reset command: keypad STOP/RESET key or pushbutton at TB2-7-TB2-1.
Speed reference source: analog reference 1, 0-10Vdc operation (speed potentiometer as shown above).

Auto Mode:

Start command: AUTO RUN pushbutton as wired above.
Stop command: AUTO STOP pushbutton as wired above.
* FWD/REV command: Contact at TB2-4-TB2-1.
Jog command: JOG contact at TB2-3-TB2-1.
Reset command: keypad STOP/RESET key or pushbutton at TB2-7-TB2-1.
Speed reference source: analog reference 2, 4-20MA operation with min speed when loss of 4-20MA signal (refer to M07P13 description for other choices).

***NOTE:** Reverse function is disabled. If FWD/REV is needed (Auto Mode Only) set M06B23 (DISABLE REV ROT) to 0 to enable.

3.7.13 RUN Forward/ RUN Reverse "2-Wire" Control



Change the following parameters in the order shown:

M06P07 (SEQUENCING MODE)	← RFWD RREV
M06B23 (DISABLE REV ROT)	← 0

- If RUN FWD and RUN REV are asserted at the same time, the drive will stop.
- Keypad RUN, STOP and FWD/REV (user key) are not operational in this sequencing mode.

The following applies for all modes below

- Jog command: JOG contact at TB2-3-TB2-1.
- Reset command: keypad STOP/RESET key or pushbutton at TB2-7-TB2-1.

Manual Mode:

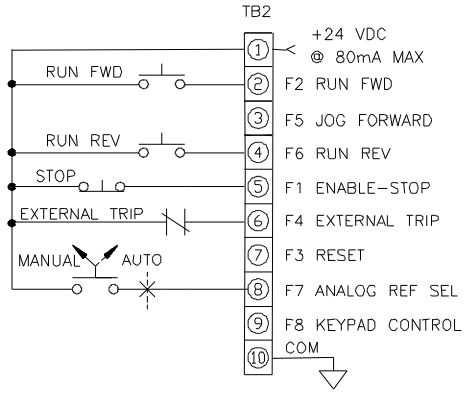
Start/Stop command forward direction: RUN FWD contact at TB2-2-TB2-1.
Start/Stop command forward direction: RUN REV contact at TB2-4-TB2-1.
Speed reference source: Analog reference 1, 0-10Vdc operation.

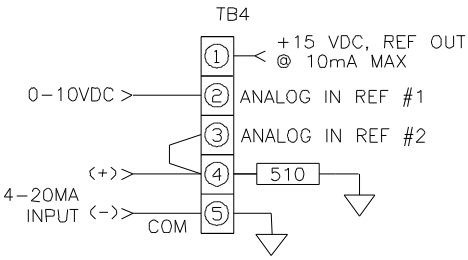
Auto Mode:

Start/Stop command forward direction: RUN FWD contact at TB2-2-TB2-1.
Start/Stop command forward direction: RUN REV contact at TB2-4-TB2-1.
Speed reference source: Analog reference 2, 4-20MA operation with min speed when loss of 4-20MA signal (refer to M07P13 description for other choices).

Note: If TB2-9 is wired to TB2-1, keypad reference is enabled (speed reference).

3.7.14 RUN Forward/ RUN Reverse "3-Wire" Control





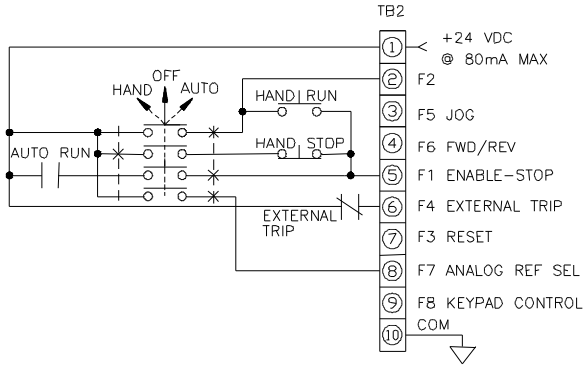
Change the following parameters in the order shown:
M06P07 (SEQUENCING MODE) ← 3-WIRE SP
M06B23 (DISABLE REV ROT) ← 0
The following applies for all modes below:
- JOG forward command:JOG FWD contact at TB2-3-TB2-1
- Reset command: pushbutton at TB2-7-TB2-1

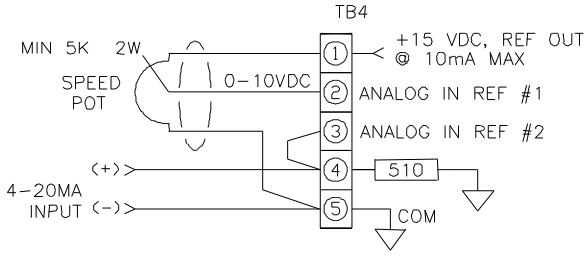
Manual Mode:
Start command forward direction: RUN FWD pushbutton at TB2-2-TB2-1.
Start command forward direction: RUN REV pushbutton at TB2-4-TB2-1.
Stop command: STOP pushbutton at TB2-5-TB2-1.
Speed reference source: Analog reference 1, 0-10Vdc operation.

Auto Mode:
Start command forward direction: RUN FWD pushbutton at TB2-2-TB2-1.
Start command forward direction: RUN REV pushbutton at TB2-4-TB2-1.
Stop command: STOP pushbutton at TB2-5-TB2-1.
Speed reference source: Analog reference 2, 4-20MA operation with min speed when loss of 4-20MA signal (refer to M07P13 description for other choices).

Note: If TB2-9 is wired to TB2-1, keypad control mode is enabled and the following has priority:
Start command: Keypad RUN key.
Stop command: Keypad STOP key.
FWD/REV command: Keypad USER key.
Speed reference source: Keypad reference M01P04.

3.7.15 Hand-Off-Auto #4A Control



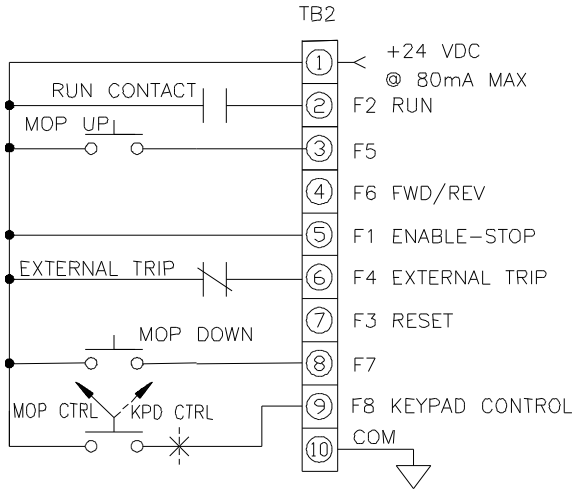


Hand Mode:
Start command: HAND RUN pushbutton as wired above.
Stop command: HAND STOP pushbutton as wired above.
* FWD/REV command: Contact at TB2-4-TB2-1.
Jog command: JOG contact at TB2-3-TB2-1.
Reset command: keypad STOP/RESET key or pushbutton at TB2-7-TB2-1.
Speed reference source: Analog reference 1, 0-10V operation (speed potentiometer as shown above).

Auto Mode:
Start/Stop command: AUTO Run contact as wired above.
* FWD/REV command: Contact at TB2-4-TB2-1.
Reset command: keypad STOP/RESET key or pushbutton at TB2-7-TB2-1.
Speed reference source: Analog reference 2, 4-20MA operation with min speed when loss of 4-20MA signal (refer to M07P13 description for other choices).

***NOTE:** Reverse function is disabled. If FWD/REV is needed set M06B23 (DISABLE REV ROT) to 0 to enable.

3.7.16 Motorized Potentiometer with "2-Wire" Control



Change the following parameters in the order shown:
M06P07 (SEQUENCING MODE) ← 2-WIRE
M08P15 (F5 INPUT DESTINA) ← 6.27 (M06B27)
M08P19 (F7 INPUT DESTINA) ← 6.28 (M06B28)
M01B07 (SEL PRESET SPEED) ← 1
M06P31 (MOP DESTINATION) ← 1.25** (M01P25)
M06P30 (MOP SCALE FACTOR) ← .060***

Keypad Control (KPD CTRL):
Start/Stop command: RUN contact at TB2-2-TB2-1.
* FWD/REV command: Contact at TB2-4-TB2-1.
Reset command: keypad STOP/RESET key or pushbutton at TB2-7-TB2-1.
Speed reference: Keypad reference M01P04

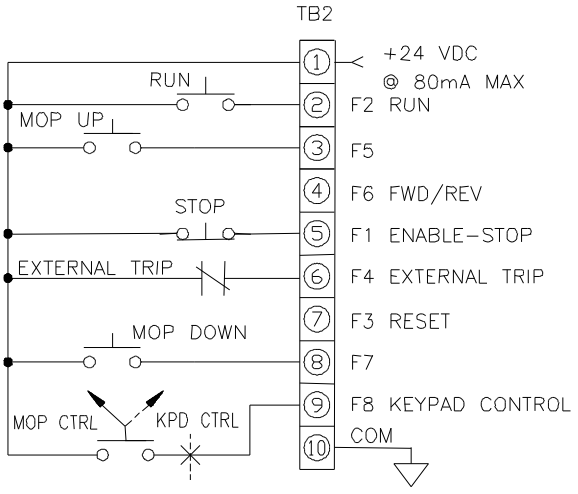
MOP Control (MOP CTRL):
Start/Stop command: RUN contact at TB2-2-TB2-1.
Speed increase: MOP UP contact at TB2-3-TB2-1.
Speed decrease: MOP DOWN contact TB2-8-TB2-1.
* FWD/REV command: Contact at TB2-4-TB2-1.
Reset command: keypad STOP/RESET key or pushbutton at TB2-7-TB2-1.

**Since the motorized potentiometer in this example controls the speed, one of the preset speed parameters (M01P25 "PRESET FREQ 1") is used as MOP destination.
***For 60Hz speed range, scale factor = 60/1000
(60 is 60Hz and 1000 is maximum value of parameter M01P25 "PRESET FREQ 1").

Use M06P26 to program ramp rate.
Refer to M06B25 & M06B29 for other MOP features.

***NOTE:** Reverse function is disabled. If FWD/REV is needed set M06B23 (DISABLE REV ROT) to 0.

3.7.17 Motorized Potentiometer with "3-Wire" Control



Change the following parameters in the order shown:
M08P15 (F5 INPUT DESTINA) ← 6.27 (M06B27)
M08P19 (F7 INPUT DESTINA) ← 6.28 (M06B28)
M01B07 (SEL PRESET SPEED) ← 1
M06P31 (MOP DESTINATION) ← 1.25** (M01P25)
M06P30 (MOP SCALE FACTOR) ← .060***

Keypad Control (KPD CTRL):
Start command: Keypad RUN key.
Stop command: Keypad STOP key.
* FWD/REV command: Keypad FWD/REV key.
Reset command: keypad STOP/RESET key or pushbutton at TB2-7-TB2-1.
Speed reference source: Keypad reference M01P04

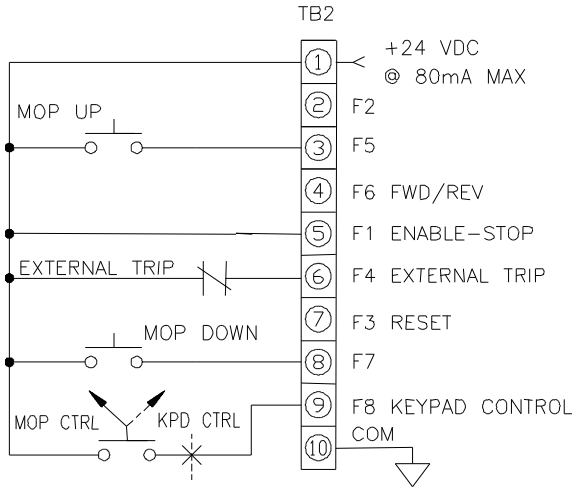
MOP Control (MOP CTRL):
Start command: RUN pushbutton at TB2-2-TB2-1.
Stop command: STOP pushbutton at TB2-5-TB2-1.
Speed increase: MOP UP contact at TB2-3-TB2-1.
Speed decrease: MOP DOWN contact TB2-8-TB2-1.
* FWD/REV command: Contact at TB2-4-TB2-1.
Reset command: keypad STOP/RESET key or pushbutton at TB2-7-TB2-1.

**Since the motorized potentiometer in this example controls the speed, one of the preset speed parameters (M01P25 "PRESET FREQ 1") is used as MOP destination.
***For 60Hz speed range, scale factor = 60/1000
(60 is 60Hz and 1000 is maximum value of parameter M01P25 "PRESET FREQ 1").

Use M06P26 to program ramp rate.
Refer to M06B25 & M06B29 for other MOP features.

***NOTE:** Reverse function is disabled. If FWD/REV is needed set M06B23 (DISABLE REV ROT) to 0 and M06P18 (KEYPAD CONT MODE) to "ALL KEYS".

3.7.18 Motorized Potentiometer with Keypad Start/Stop



Change the following parameters in the order shown:

M06P18 (KEYPAD CONT MODE)	← NO KEYS
M06B15 (EN KEYPAD RUN)	← 1
M06B16 (EN KEYPAD STOP)	← 1
M06B17 (EN KEYPAD FWD/RV)	← 0
M08P15 (F5 INPUT DESTINA)	← 6.27 (M06B27)
M08P19 (F7 INPUT DESTINA)	← 6.28 (M06B28)
M01B07 (SEL PRESET SPEED)	← 1
M06P31 (MOP DESTINATION)	← 1.25** (M01P25)
M06P30 (MOP SCALE FACTOR)	← .060***

Keypad Control (KPD CTRL):

Start command: Keypad RUN key.
Stop command: Keypad STOP key.
Reset command: keypad STOP/RESET key or pushbutton at TB2-7-TB2-1.
* FWD/REV command: Keypad FWD/REV key
Speed reference source: Keypad reference M01P04

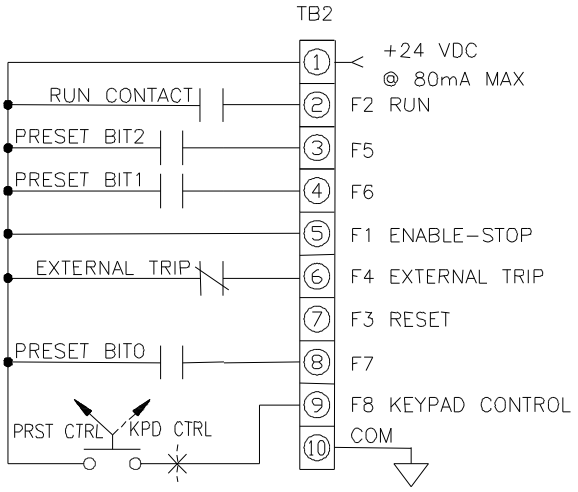
MOP Control (MOP CTRL):

Start command: Keypad RUN key.
Stop command: Keypad STOP key.
Speed increase: MOP UP contact at TB2-3-TB2-1.
Speed decrease: MOP DOWN contact TB2-8-TB2-1.
* FWD/REV command: Contact at TB2-4-TB2-1.
Reset command: keypad STOP/RESET key or pushbutton at TB2-7-TB2-1.

**Since the motorized potentiometer in this example controls the speed, one of the preset speed parameters (M01P25 "PRESET FREQ 1") is used as MOP destination.
***For 60Hz speed range, scale factor = 60/1000
(60 is 60Hz and 1000 is maximum value of parameter M01P25 "PRESET FREQ 1").
Use M06P26 to program ramp rate.
Refer to M06B25 & M06B29 for other MOP features.

***NOTE:** Reverse function is disabled. If FWD/REV is needed set M06B23 (DISABLE REV ROT) to 0 and M06B17 (EN KEYPAD FWD/RV) to 1.

3.7.19 Preset Speeds with "2-Wire" Control



Change the following parameters in the order shown:

M06P07 (SEQUENCING MODE)	← 2-WIRE
M01B07 (SEL PRESET SPEED)	← 1
M02B07 (RAMPS SELECTION)	← 1
M08P15 (F5 INPUT DESTINA)	← 1.24 (M01B24)
M08P17 (F6 INPUT DESTINA)	← 1.23 (M01B23)
M08P19 (F7 INPUT DESTINA)	← 1.22 (M01B22)

Keypad Control (KPD CTRL):

Start/Stop command: RUN contact at TB2-2-TB2-1.
Reset command: keypad STOP/RESET key or pushbutton at TB2-7-TB2-1.
Speed reference source: Keypad reference M01P04

Preset Speed Control (PRST CTRL):

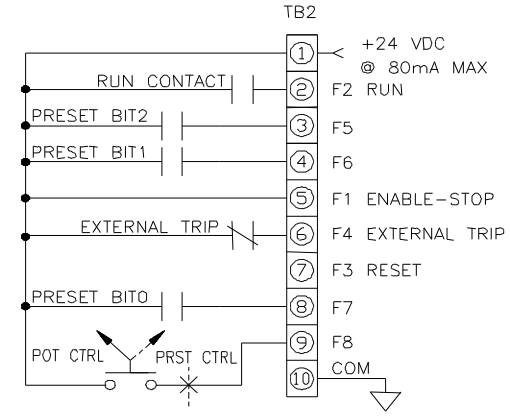
Start/Stop command: RUN contact at TB2-2-TB2-1.
Reset command: keypad STOP/RESET key or pushbutton at TB2-7-TB2-1.
Speed reference source:

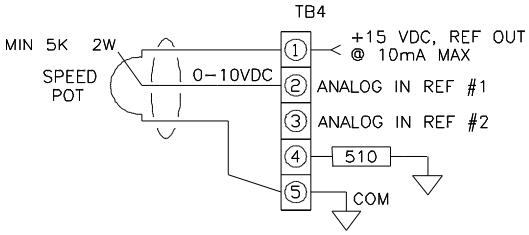
BIT2	BIT1	BIT0	DRIVE SPEED	DRIVE ACCEL/DECEL
0	0	0	PRESET FREQ1	ACCEL1/DECEL1
0	0	1	PRESET FREQ2	ACCEL2/DECEL2
0	1	0	PRESET FREQ3	ACCEL3/DECEL3
0	1	1	PRESET FREQ4	ACCEL4/DECEL4
1	0	0	PRESET FREQ5	ACCEL5/DECEL5
1	0	1	PRESET FREQ6	ACCEL6/DECEL6
1	1	0	PRESET FREQ7	ACCEL7/DECEL7
1	1	1	PRESET FREQ8	ACCEL8/DECEL8

Program the following preset speeds and corresponding acceleration/deceleration for the desired speed profile:
**M01P25 to M01P32: PRESET FREQ 1 to PRESET FREQ 8
M02P03: ACCEL 1
M02P11 to M02P17: ACCEL 2 to ACCEL8
M02P04: DECEL 1
M02P21 to M02P27: DECEL 2 to DECEL 8

***NOTE:** Reverse function is disabled. If FWD/REV is needed set M06B23 (DISABLE REV ROT) to 0.
****NOTE:** If some of the preset speeds are negative, reverse rotation is allowed by setting M06B23 (DISABLE REV ROT) to 0 and M01B10 (BIPOLAR SELECT) to 1.

3.7.19.a Preset Speeds with "2-Wire" Control & Speed Pot





Change the following parameters in the order shown:

M06P07 (SEQUENCING MODE)	← 2-WIRE
M02B07 (RAMPS SELECTION)	← 1
M08P15 (F5 INPUT DESTINA)	← 1.24 (M01B24)
M08P17 (F6 INPUT DESTINA)	← 1.23 (M01B23)
M08P19 (F7 INPUT DESTINA)	← 1.22 (M01B22)
M08P21 (F8 INPUT DESTINA)	← 1.07 (M01B07)
M01B08 (KEYPAD CONTROL)	← 0

Speed Pot Control (POT CTRL):

Start/Stop command: RUN contact at TB2-2-TB2-1.
Reset command: keypad STOP/RESET key or pushbutton at TB2-7-TB2-1.
Speed reference source: Analog reference 1, 0-10Vdc operation (Speed Potentiometer as shown)

Preset Speed Control (PRST CTRL):

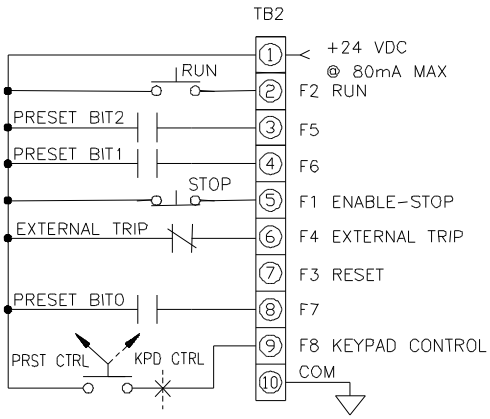
Start/Stop command: RUN contact at TB2-2-TB2-1.
Reset command: keypad STOP/RESET key or pushbutton at TB2-7-TB2-1.
Speed reference source:

BIT2	BIT1	BIT0	DRIVE SPEED	DRIVE ACCEL/DECEL
0	0	0	PRESET FREQ1	ACCEL1/DECEL1
0	0	1	PRESET FREQ2	ACCEL2/DECEL2
0	1	0	PRESET FREQ3	ACCEL3/DECEL3
0	1	1	PRESET FREQ4	ACCEL4/DECEL4
1	0	0	PRESET FREQ5	ACCEL5/DECEL5
1	0	1	PRESET FREQ6	ACCEL6/DECEL6
1	1	0	PRESET FREQ7	ACCEL7/DECEL7
1	1	1	PRESET FREQ8	ACCEL8/DECEL8

Program the following preset speeds and corresponding acceleration/deceleration for the desired speed profile:
**M01P25 to M01P32: PRESET FREQ 1 to PRESET FREQ 8
M02P03: ACCEL 1
M02P11 to M02P17: ACCEL 2 to ACCEL8
M02P04: DECEL 1
M02P21 to M02P27: DECEL 2 to DECEL 8

****NOTE**: If some of the preset speeds are negative, reverse rotation is allowed by setting M06B23 (DISABLE REV ROT) to 0 and M01B10 (BIPOLAR SELECT) to 1.

3.7.20 Preset Speeds with "3-Wire" Control



Change the following parameters in the order shown:

M01B07 (SEL PRESET SPEED)	← 1
M02B07 (RAMPS SELECTION)	← 1
M08P15 (F5 INPUT DESTINA)	← 1.24 (M01B24)
M08P17 (F6 INPUT DESTINA)	← 1.23 (M01B23)
M08P19 (F7 INPUT DESTINA)	← 1.22 (M01B22)

Keypad Control (KPD CTRL):

Start command: Keypad RUN key.
Stop command: Keypad STOP key.
* FWD/REV command: Keypad FWD/REV key.
Reset command: keypad STOP/RESET key or pushbutton at TB2-7-TB2-1.
Speed reference source: Keypad reference M01P04

Preset Speed Control (PRST CTRL):

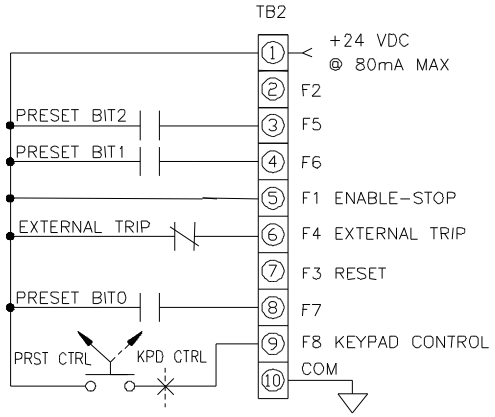
Start command: RUN pushbutton at TB2-2-TB2-1.
Stop command: STOP pushbutton at TB2-5-TB2-1.
Reset command: keypad STOP/RESET key or pushbutton at TB2-7-TB2-1.
Speed reference source:

BIT2	BIT1	BIT0	DRIVE SPEED	DRIVE ACCEL/DECEL
0	0	0	PRESET FREQ1	ACCEL1/DECEL1
0	0	1	PRESET FREQ2	ACCEL2/DECEL2
0	1	0	PRESET FREQ3	ACCEL3/DECEL3
0	1	1	PRESET FREQ4	ACCEL4/DECEL4
1	0	0	PRESET FREQ5	ACCEL5/DECEL5
1	0	1	PRESET FREQ6	ACCEL6/DECEL6
1	1	0	PRESET FREQ7	ACCEL7/DECEL7
1	1	1	PRESET FREQ8	ACCEL8/DECEL8

Program the following preset speeds and corresponding acceleration/deceleration for the desired speed profile:
**M01P25 to M01P32: PRESET FREQ 1 to PRESET FREQ 8
M02P03: ACCEL 1
M02P11 to M02P17: ACCEL 2 to ACCEL8
M02P04: DECEL 1
M02P21 to M02P27: DECEL 2 to DECEL 8

***NOTE:** Reverse function is disabled. If FWD/REV is needed set M06B23 (DISABLE REV ROT) to 0 and M06P18 (KEYPAD CONT MODE) to "ALL KEYS".
****NOTE:** If some of the preset speeds are negative, reverse rotation is allowed by setting M06B23 (DISABLE REV ROT) to 0 and M01B10 (BIPOLAR SELECT) to 1.

3.7.21 Preset Speeds with Keypad Start/Stop



Change the following parameters in the order shown:

M06P18 (KEYPAD CONT MODE) ← NO KEYS
M06B15 (EN KEYPAD RUN) ← 1
M06B16 (EN KEYPAD STOP) ← 1
M06B17 (EN KEYPAD FWD/RV) ← 0
M01B07 (SEL PRESET SPEED) ← 1
M02B07 (RAMPS SELECTION) ← 1
M08P15 (F5 INPUT DESTINA) ← 1.24 (M01B24)
M08P17 (F6 INPUT DESTINA) ← 1.23 (M01B23)
M08P19 (F7 INPUT DESTINA) ← 1.22 (M01B22)

The following applies for all modes below

- Reset command: keypad STOP/RESET key or pushbutton at TB2-7-TB2-1.

Keypad Control (KPD CTRL):

Start command: Keypad RUN key.
Stop command: Keypad STOP key.
* FWD/REV command: Keypad FWD/REV key.
Speed reference source: Keypad reference M01P04

Preset Speed Control (PRST CTRL):

Start command: RUN pushbutton at TB2-2-TB2-1.
Stop command: STOP pushbutton at TB2-5-TB2-1.
Speed reference source:

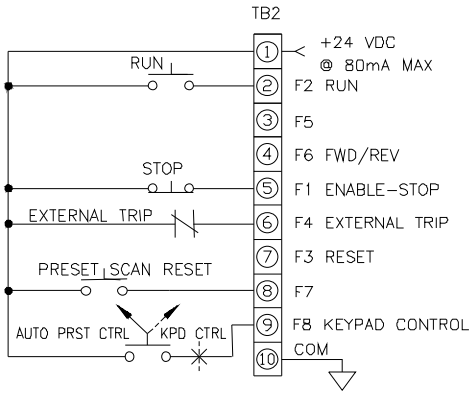
BIT2	BIT1	BIT0	DRIVE SPEED	DRIVE ACCEL/DECEL
0	0	0	PRESET FREQ1	ACCEL1/DECEL1
0	0	1	PRESET FREQ2	ACCEL2/DECEL2
0	1	0	PRESET FREQ3	ACCEL3/DECEL3
0	1	1	PRESET FREQ4	ACCEL4/DECEL4
1	0	0	PRESET FREQ5	ACCEL5/DECEL5
1	0	1	PRESET FREQ6	ACCEL6/DECEL6
1	1	0	PRESET FREQ7	ACCEL7/DECEL7
1	1	1	PRESET FREQ8	ACCEL8/DECEL8

Program the following preset speeds and corresponding acceleration/deceleration for the desired speed profile:
**M01P25 to M01P32: PRESET FREQ 1 to PRESET FREQ 8
M02P03: ACCEL 1
M02P11 to M02P17: ACCEL 2 to ACCEL8
M02P04: DECEL 1
M02P21 to M02P27: DECEL 2 to DECEL 8

***NOTE:** Reverse function is disabled. If FWD/REV is needed set M06B23 (DISABLE REV ROT) to 0 and M06B17 (EN KEYPAD FWD/RV) to 1.

****NOTE:** If some of the preset speeds are negative, reverse rotation is allowed by setting M06B23 (DISABLE REV ROT) to 0 and M01B10 (BIPOLAR SELECT) to 1.

3.7.21.a Auto Preset Scan Timer with "3-Wire" Control



Change the following parameters in the order shown:

M01B07 (SEL PRESET SPEED) ←1 (ENABLE PRESET SCAN TIMER)
M01B42 (PRESET SEL MODE) ← 1
M01P43 (PRESET SCAN MODE) ← 1CYC&STOP
M02B07 (RAMPS SELECTION) ← 1 (SYNC RAMPS TO PRESETS)
M08P19 (F7 INPUT DESTINA) ← 1.45 (PRESET SCAN RSET)
M09P14 (BIT SEL2 SOURCE1) ← 10.02 (DRIVE RUNNING)
M09B15 (BIT SEL2 SR1 INV) ← 1
M09P37 (BITSEL2 OUT DEST) ← 1.46 (PRESET SCAN HALT)

The following applies for all modes below

- Reset command: keypad STOP/RESET key or pushbutton at TB2-7-TB2-1.

Keypad Control (KPD CTRL):

Start command: Keypad RUN key.
Stop command: Keypad STOP key.
* FWD/REV command: Keypad FWD/REV key.
Speed reference source: Keypad reference M01P04

Auto Preset Scan Timer Control (AUTO PRESET CTRL):

Start command: RUN pushbutton at TB2-2-TB2-1.
Stop command: STOP pushbutton at TB2-5-TB2-1.
Preset Scan Reset: Pushbutton at TB2-8-TB2-1.
Speed reference source: PRESET INDICATOR

BIT2	BIT1	BIT0	DRIVE SPEED	DRIVE ACCEL/DECEL	TIME IN PRESETS
0	0	0	PRESET FREQ1	ACCEL1/DECEL1	TIME IN PRESET 1
0	0	1	PRESET FREQ2	ACCEL2/DECEL2	TIME IN PRESET 2
0	1	0	PRESET FREQ3	ACCEL3/DECEL3	TIME IN PRESET 3
0	1	1	PRESET FREQ4	ACCEL4/DECEL4	TIME IN PRESET 4
1	0	0	PRESET FREQ5	ACCEL5/DECEL5	TIME IN PRESET 5
1	0	1	PRESET FREQ6	ACCEL6/DECEL6	TIME IN PRESET 6
1	1	0	PRESET FREQ7	ACCEL7/DECEL7	TIME IN PRESET 7
1	1	1	PRESET FREQ8	ACCEL8/DECEL8	TIME IN PRESET 8

Program the following preset speeds and corresponding acceleration/deceleration and time in presets for the desired speed profile:
**M01P25 to M01P32: PRESET FREQ 1 to PRESET FREQ 8
M02P03: ACCEL 1
M02P11 to M02P17: ACCEL 2 to ACCEL8
M02P04: DECEL 1
M02P21 to M02P27: DECEL 2 to DECEL 8
M01P47 to M01P54: TIME IN PRESET 1 to TIME IN PRESET 8

***NOTE:** Reverse function is disabled. If FWD/REV is needed set M06B23 (DISABLE REV ROT) to 0 and M06B17 (EN KEYPAD FWD/RV) to 1.
****NOTE:** If some of the preset speeds are negative, reverse rotation is allowed by setting M06B23 (DISABLE REV ROT) to 0 and M01B10 (BIPOLAR SELECT) to 1.

Additional Notes:

When Programmed as shown, after the RUN pushbutton is pressed, the drive will run one cycle, then stop. If the drive is stopped by pressing the STOP pushbutton before the cycle has completed, the drive will decelerate using the presently active decel rate and the scan cycle is paused or halted at its present stage. This is because parameter M01B46 (PRESET SCAN HALT) is set at 1 when the drive is not in the RUN state. If the RUN pushbutton is now pressed, the scan cycle will resume from the beginning of the stage when the drive was stopped and the cycle was suspended. If, after the initial stop, one desires to reset the cycle before starting the drive again, press the Preset Scan Reset pushbutton before pressing the RUN pushbutton.

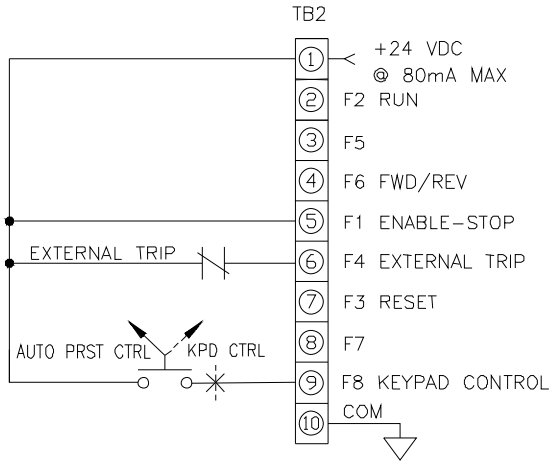
If a fault occurs in the middle of a cycle, the scan cycle is also paused or halted at its present stage. After fault is reset, the scan cycle can be resumed or reset to the beginning as described in the section above.

As a final note, if the resumption of a cycle after stopping or upon clearing a fault is not desired, but instead, it is desired that the cycle restart at the beginning upon pressing the RUN pushbutton, make the following changes:

Eliminate the Preset Scan Reset pushbutton and the programming of parameter M08P19 (F7 INPUT DESTINA).

Reprogram parameter M09P37 (BITSEL2 OUT DEST) to 1.45 (PRESET SCAN RSET).

3.7.21.b Auto Preset Scan Timer with Keypad Start/Stop



Change the following parameters in the order shown:
M01B07 (SEL PRESET SPEED) ← 1
M01B42 (PRESET SEL MODE) ← 1
M01P43 (PRESET SCAN MODE) ← 1CYC&STOP
M02B07 (RAMPS SELECTION) ← 1 (SYNC RAMPS TO PRESETS)
M06P18 (KEYPAD CONT MODE) ← NO KEYS
M06B15 (EN KEYPAD RUN) ← 1
M06B16 (EN KEYPAD STOP) ← 1
M06B17 (EN KEYPAD FWD/RV) ← 0
M09P08 (BIT SEL1 SOURCE1) ← 6.13 (KEYPAD STOP)
M09P10 (BIT SEL1 SOURCE2) ← 10.02 (DRIVE RUNNING)
M09B11 (BIT SEL1 SR2 INV) ← 1
M09P14 (BIT SEL2 SOURCE1) ← 10.02 (DRIVE RUNNING)
M09B15 (BIT SEL2 SR1 INV) ← 1
M09P35 (BITSEL1 OUT DEST) ← 1.45 (PRESET SCAN RSET)
M09P37 (BITSEL2 OUT DEST) ← 1.46 (PRESET SCAN HALT)

The following applies for all modes below
- Reset command: keypad STOP/RESET key or pushbutton at TB2-7-TB2-1.

Keypad Control (KPD CTRL):
Start command: Keypad RUN key.
Stop command: Keypad STOP key.
* FWD/REV command: Keypad FWD/REV key.
Speed reference source: Keypad reference M01P04

Auto Preset Scan Timer Control (AUTO PRESET CTRL):
Start command: Keypad RUN key.
Stop command: Keypad STOP key.
Preset Scan Reset: Keypad STOP/RESET key when drive is not in RUN state.
Speed reference source: PRESET INDICATOR

BIT 2	BIT 1	BIT 0	DRIVE SPEED	DRIVE ACCEL/DECEL	TIME IN PRESETS
0	0	0	PRESET FREQ1	ACCEL1/DECEL1	TIME IN PRESET 1
0	0	1	PRESET FREQ2	ACCEL2/DECEL2	TIME IN PRESET 2
0	1	0	PRESET FREQ3	ACCEL3/DECEL3	TIME IN PRESET 3
0	1	1	PRESET FREQ4	ACCEL4/DECEL4	TIME IN PRESET 4
1	0	0	PRESET FREQ5	ACCEL5/DECEL5	TIME IN PRESET 5
1	0	1	PRESET FREQ6	ACCEL6/DECEL6	TIME IN PRESET 6
1	1	0	PRESET FREQ7	ACCEL7/DECEL7	TIME IN PRESET 7
1	1	1	PRESET FREQ8	ACCEL8/DECEL8	TIME IN PRESET 8

Program the following preset speeds and corresponding acceleration/deceleration and time in presets for the desired speed profile:
**M01P25 to M01P32: PRESET FREQ 1 to PRESET FREQ 8

M02P03: ACCEL 1
M02P11 to M02P17: ACCEL 2 to ACCEL8
M02P04: DECEL 1
M02P21 to M02P27: DECEL 2 to DECEL 8
M01P47 to M01P54: TIME IN PRESET 1 to TIME IN PRESET 8

***NOTE:** Reverse function is disabled. If FWD/REV is needed set M06B23 (DISABLE REV ROT) to 0 and M06B17 (EN KEYPAD FWD/RV) to 1.
****NOTE:** If some of the preset speeds are negative, reverse rotation is allowed by setting M06B23 (DISABLE REV ROT) to 0 and M01B10 (BIPOLAR SELECT) to 1.

Additional Notes:

When Programmed as shown, after the Keypad RUN key is pressed, the drive will run one cycle, then stop. If the drive is stopped by pressing the Keypad STOP key before the cycle has completed, the drive will decelerate using the presently active decel rate and the scan cycle is paused or halted at its present stage. This is because parameter M01B46 (PRESET SCAN HALT) is set at 1 when the drive is not in the RUN state. If the Keypad RUN key is now pressed, the scan cycle will resume from the beginning of the stage when the drive was stopped and the cycle was suspended. If, after the initial stop, one desires to reset the cycle before starting the drive again, press the Keypad STOP key before pressing the Keypad RUN key.

If a fault occurs in the middle of a cycle, the scan cycle is also paused or halted at its present stage. If the fault is reset by using the Keypad STOP key, the scan cycle is also reset to the beginning because of the way the Keypad STOP key has been programmed by the BIT SEL1 parameters. If the fault is reset using pushbutton at TB2-7-TB2-1, the scan cycle will be resumed when the Keypad RUN key is pressed.

As a final note, if the resumption of a cycle after stopping or upon clearing a fault is not desired, but instead, it is desired that the cycle restart at the beginning upon pressing the RUN pushbutton, make the following changes:

De-activate the following parameters by reprogramming them to:
M09P08 (BIT SEL1 SOURCE1) ← 0.0
M09P10 (BIT SEL1 SOURCE2) ← 0.0
M09B11 (BIT SEL1 SR2 INV) ← 0
M09P35 (BITSEL1 OUT DEST) ← 0.0

Reprogram parameter M09P37 (BITSEL2 OUT DEST) to 1.45 (PRESET SCAN RSET).

3.7.22 Auto-Restart Typical Setup

Example #1:
M06P02 (AUTO-START MODE) ← RUNNING
M10B25 (ENABLE AUTORESET) ← 1
M10P26 (RESET DELAY) ← 5
M10P27 (NO OF AR ATTEMPTS) ← 5
M10B28 (VFD OK DELAYED) ← 0
M10P35 (AUTORESET MODE) ← PWR LOSS

Example #2:
M06P02 (AUTO-START MODE) ← RUNNING
M10B25 (ENABLE AUTORESET) ← 1
M10P26 (RESET DELAY) ← 5
M10P27 (NO OF AR ATTEMPTS) ← 5
M10B28 (VFD OK DELAYED) ← 1
M10P35 (AUTORESET MODE) ← PWR LOSS

The following is a description of the parameters above that can be changed to achieve different auto-restart features:

M06P02 "AUTO-START MODE":
There are three modes:
[0] Disabled: The drive will not automatically start when AC power is applied.
[1] Always: The drive always starts when AC power is applied.
[2] Running: The drive starts only if it had been running when AC power was previously removed.

M10B25 "ENABLE AUTORESET":
If set to 1, the drive will be automatically reset when tripped after a programmed delay set in M10P26 "RESET DELAY"

M10P26 "RESET DELAY":
Enter the auto-reset delay in seconds
When the programmed value of M10P27 "NO OF AR ATTEMPTS" is reached, any further trips of the same type will not cause a reset. A trip of a different type will cause a reset.

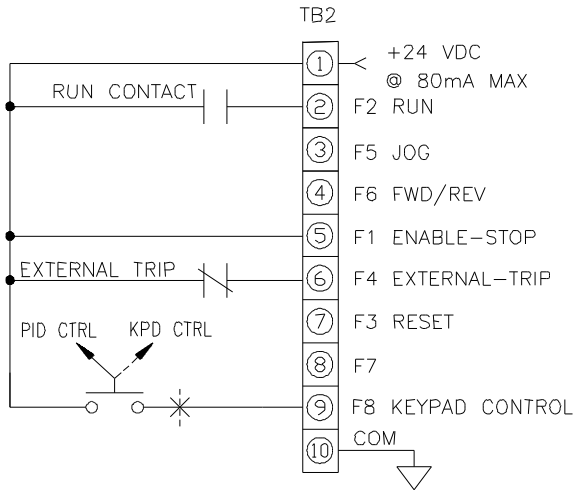
M10P27 "NO OF AR ATTEMPTS":
If no trip has occurred for 10 minutes, the reset count is cleared

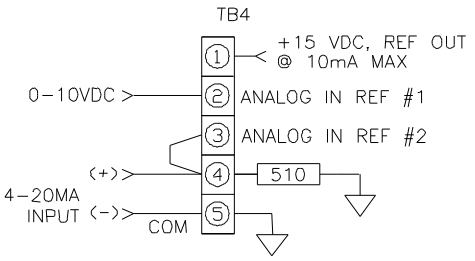
M10B28 "VFD OK DELAYED"
This parameter can be used to hold "Drive Normal" status bit M10B01 at 1 until the last Auto-Reset Attempt is used.
Set M10B28 to 1 for "Drive Normal" status bit M10B01 to remain set at 1 every time a trip occurs and "Auto-Reset" is going to occur.

Set M10B28 to 0 to immediately clear "Drive Normal" status bit M10B01 at 0 every time a trip occurs, regardless of any Auto-reset that may occur.

M10P35 "AUTORESET MODE"
Use this parameter to select how parameter M10B25 "ENABLE AUTORESET" function operates. If "PWR LOSS" is selected, only the undervoltage fault is cleared and if "ALLFAULTS" is selected than all faults are cleared.

3.7.23 PID with "2-Wire" Control





Change the following parameters in the order shown:
M06P07 (SEQUENCING MODE) ← 2-WIRE
M01B07 (SEL PRESET SPEED) ← 1
M14P03 (PID REF SOURCE) ← 1.19 (M01P19)
M14P04 (PID FEEDBACK SRC) ← 1.20 (M01P20)
M14B08 (PID ENABLE) ← 1
M14P15 (PID OUT SCALING) ← 0.060**
M14P16 (PID OUT DESTINAT) ← 1.25*** (M01P25)

See 3.7.26 PID Additional Notes for more information.

Keypad Control (KPD CTRL):
Start/Stop command: RUN contact at TB2-2-TB2-1.
* FWD/REV command: Contact at TB2-4-TB2-1.
Jog command: JOG contact at TB2-3-TB2-1.
Reset command: keypad STOP/RESET key or pushbutton at TB2-7-TB2-1.
Speed reference: Keypad reference M01P04

PID Control (PID CTRL):
Start/Stop command: RUN contact at TB2-2-TB2-1.
PID Reference: Analog Ref#1 at TB4-2, 0-10Vdc .

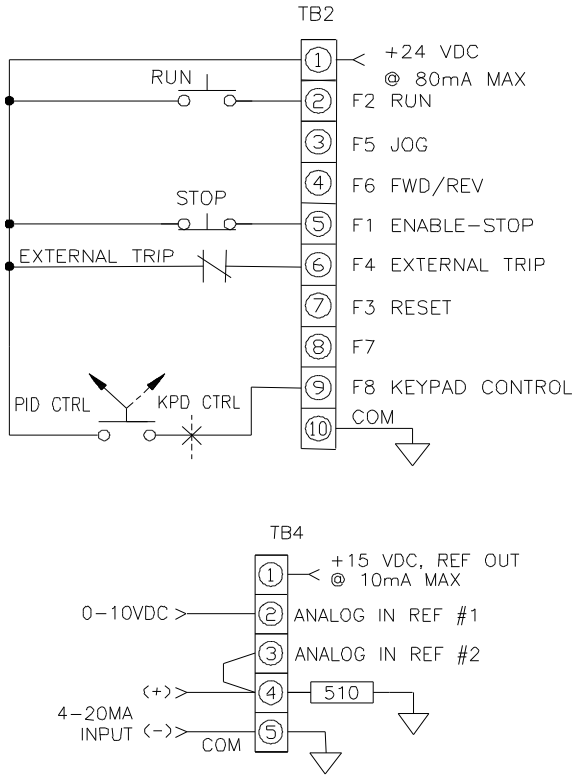
PID Feedback: Analog Ref#2 at TB4-4, 4-20MA.
* FWD/REV command: Contact at TB2-4-TB2-1.
Jog command: JOG contact at TB2-3-TB2-1.
Reset command: keypad STOP/RESET key or pushbutton at TB2-7-TB2-1.

**For 60Hz motor speed range, scale factor = 60/1000
(60 is 60Hz and 1000 is maximum value of parameter M01P25 "PRESET FREQ 1").

***Since the PID output in this example controls the speed, one of the preset speed parameters M01P25 "PRESET FREQ 1" is used as PID output destination. If the PID is to trim speed then it is suggested that parameter M01P15 "REF OFFSET" is used and set P01M16 "REF OFFSET SEL" to 1.

***NOTE:** Reverse function is disabled. If FWD/REV is needed set M06B23 (DISABLE REV ROT) to 0.

3.7.24 PID with "3-Wire" Control



Change the following parameters in the order shown:
M01B07 (SEL PRESET SPEED) ← 1
M14P03 (PID REF SOURCE) ← 1.19 (M01P19)
M14P04 (PID FEEDBACK SRC) ← 1.20 (M01P20)
M14B08 (PID ENABLE) ← 1
M14P15 (PID OUT SCALING) ← 0.060**
M14P16 (PID OUT DESTINAT) ← 1.25*** (M01P25)

See 3.7.26 PID Additional Notes for more information.

Keypad Control (KPD CTRL):
Start command: Keypad RUN key.
Stop command: Keypad STOP key.
* FWD/REV command: Keypad USER key.
Jog command: JOG contact at TB2-3-TB2-1.
Reset command: keypad STOP/RESET key or pushbutton at TB2-7-TB2-1.
Speed reference source: Keypad reference M01P04

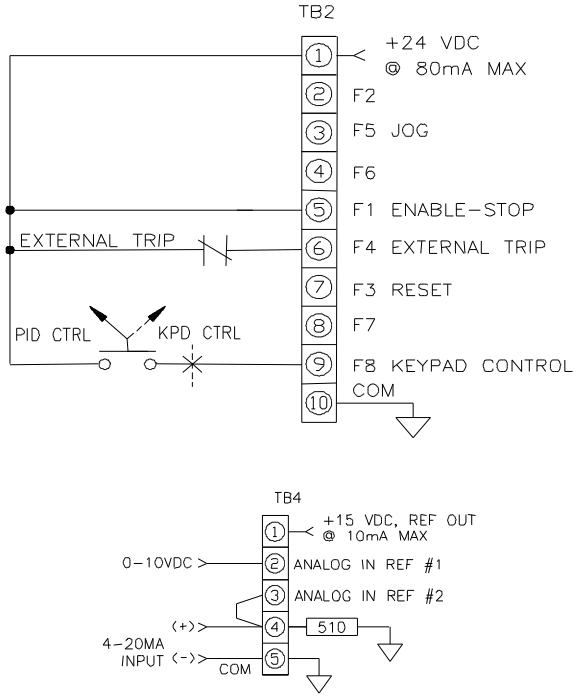
PID Control (PID CTRL):
Start command: RUN pushbutton at TB2-2-TB2-1.
Stop command: STOP pushbutton at TB2-5-TB2-1.
PID Reference: Analog Ref#1 at TB4-2, 0-10Vdc .
PID Feedback: Analog Ref#2 at TB4-4, 4-20MA.
* FWD/REV command: Contact at TB2-4-TB2-1.
Jog command: JOG contact at TB2-3-TB2-1.
Reset command: keypad STOP/RESET key or pushbutton at TB2-7-TB2-1.

**For 60Hz motor speed range, scale factor = 60/1000
(60 is 60Hz and 1000 is maximum value of parameter M01P25 "PRESET FREQ 1").

***Since the PID output in this example controls the speed, one of the preset speed parameters M01P25 "PRESET FREQ 1" is used as PID output destination. If the PID is to trim speed then it is suggested that parameter M01P15 "REF OFFSET" is used and set P01M16 "REF OFFSET SEL" to 1.

***NOTE:** Reverse function is disabled. If FWD/REV is needed set M06B23 (DISABLE REV ROT) to 0 and M06P18 (KEYPAD CONT MODE) to "ALL KEYS".

3.7.25 PID with Keypad Start/Stop



Change the following parameters in the order shown:
M06P18 (KEYPAD CONT MODE) ← NO KEYS
M06B15 (EN KEYPAD RUN) ← 1
M06B16 (EN KEYPAD STOP) ← 1
M06B17 (EN KEYPAD FWD/RV) ← 0
M01B07 (SEL PRESET SPEED) ← 1
M14P03 (PID REF SOURCE) ← 1.19 (M01P19)
M14P04 (PID FEEDBACK SRC) ← 1.20 (M01P20)
M14B08 (PID ENABLE) ← 1
M14P15 (PID OUT SCALING) ← 0.060**
M14P16 (PID OUT DESTINAT) ← 1.25*** (M01P25)

See 3.7.26 PID Additional Notes for more information.

Keypad Control (KPD CTRL):
Start command: Keypad RUN key.
Stop command: Keypad STOP key.
Jog command: JOG contact at TB2-3-TB2-1.

Reset command: keypad STOP/RESET key or pushbutton at TB2-7-TB2-1.

* FWD/REV command: Keypad USER key
Speed reference source: Keypad reference M01P04

PID Control (PID CTRL):
Start command: Keypad RUN key.
Stop command: Keypad STOP key.
PID Reference: Analog Ref#1 at TB4-2, 0-10Vdc .
PID Feedback: Analog Ref#2 at TB4-4, 4-20MA.

* FWD/REV command: Keypad USER key.
Jog command: JOG contact at TB2-3-TB2-1.
Reset command: keypad STOP/RESET key or pushbutton at TB2-7-TB2-1.

**For 60Hz motor speed range, scale factor = 60/1000
(60 is 60Hz and 1000 is maximum value of parameter M01P25 "PRESET FREQ 1").

***Since the PID output in this example controls the speed, one of the preset speed parameters M01P25 "PRESET FREQ 1") is used as PID output destination. If the PID is to trim speed then it is suggested that parameter M01P15 "REF OFFSET" is used and set P01M16 "REF OFFSET SEL" to 1.

***NOTE**: Reverse function is disabled. If FWD/REV is needed set M06B23 (DISABLE REV ROT) to 0 and M06B17 (EN KEYPAD FWD/RV) to 1.

3.7.26 PID Additional Notes:

The following applies to the above PID setups:

In above setups PID setpoint M14P03 is analog ref #1, 0-10Vdc.
In above setups PID feedback M14P04 is analog ref #2, 4-20MA.
If a digital setpoint is desired, one can choose for example a preset frequency parameter such as M01P26 "PRESET FREQ 2".

Note that M00P06 "ACCEL RAMP 1" & M00P07 "DECEL RAMP 1" set the acceleration and deceleration rates of the PID output. Use M14P07 "PID REF SLEWRATE" to ramp the PID setpoint M14P03.

PID proportional gain M14P10, integral gain M14P11 and derivative gain M14P12:
With an error of 100%, if M14P10 = 1.000 the output produced by the proportional term is 100%.
With an error of 100%, if M14P11 = 1.000 the output produced by the integral term will increase linearly by 100% every second.
With an error that is increasing by 100% per second, if M14P12 = 1.000 the output produced by the D term will be 100%.

If a minimum and a maximum are needed for the PID output, use M14P13 "PID HIGH LIMIT" and M14P14 "PID LOW LIMIT".

PID Input Scaling:
All variable inputs to the PID (M14P02, M14P03 & M14P04) are automatically scaled to variables having the range ±100.0%, or 0 - 100.0% if they are unipolar.

Example: PID setpoint M14P03 is programmed as M01P26 "PRESET FREQ 2".
Since M01P26 has a range ±1000.0 a value entered in M01P26 of +1000.0 is automatically scaled to +100% for M14P03 and a value of +500.0 is automatically scaled to 50% for M14P03.

PID Output Scaling:
The output after the scale factor M14P15 is automatically scaled to match the range of the destination parameter.

Example: motor speed range is 60Hz and PID destination is M01P25 "PRESET FREQ 1".
Since M01P25 has a range of ±1000.0 the PID output scale M14P15 should be set to 0.060 (60/1000).

Displaying PID Setpoint & Feedback:
Use the two programmable display parameters M00P19 & M00P20.

M11P19 defines M00P19 and M11P20 defines M11P20.
M14P17 is a parameter that monitors PID reference and internally scaled to ±100%.
M14P18 is a parameter that monitors PID feedback and internally scaled to ±100%.

M11P19 ← M14P17 (display parameter M00P19 = M14P17)
M11P20 ← M14P18 (display parameter M00P20 = M14P18)

To scale M00P19:
M11P21 ← 1.000 (to display units in % scale = 100% x 1.000).
The scale can be changed to represent a meaningful engineering unit.

To scale M00P20:
M11P22 ← 1.000 (to display units in % scale = 100% x 1.000).
The scale can be changed to represent a meaningful engineering unit.

To change text in M00P19 & M00P20:
M11P31 ← SETPOINT (text for M00P19)
M11P32 ← FEEDBACK (text for M00P20)

Note: A user can setup M00P19 & M00P20 scale factors to mean engineering units such as 250 PSI for range. Also a user can choose M00P19 & M00P20 text from a selection of appropriate texts defined in M11P31 & M11P32.

4.0 MENU AND PARAMETER DESCRIPTIONS

4.1 MENU DESCRIPTIONS

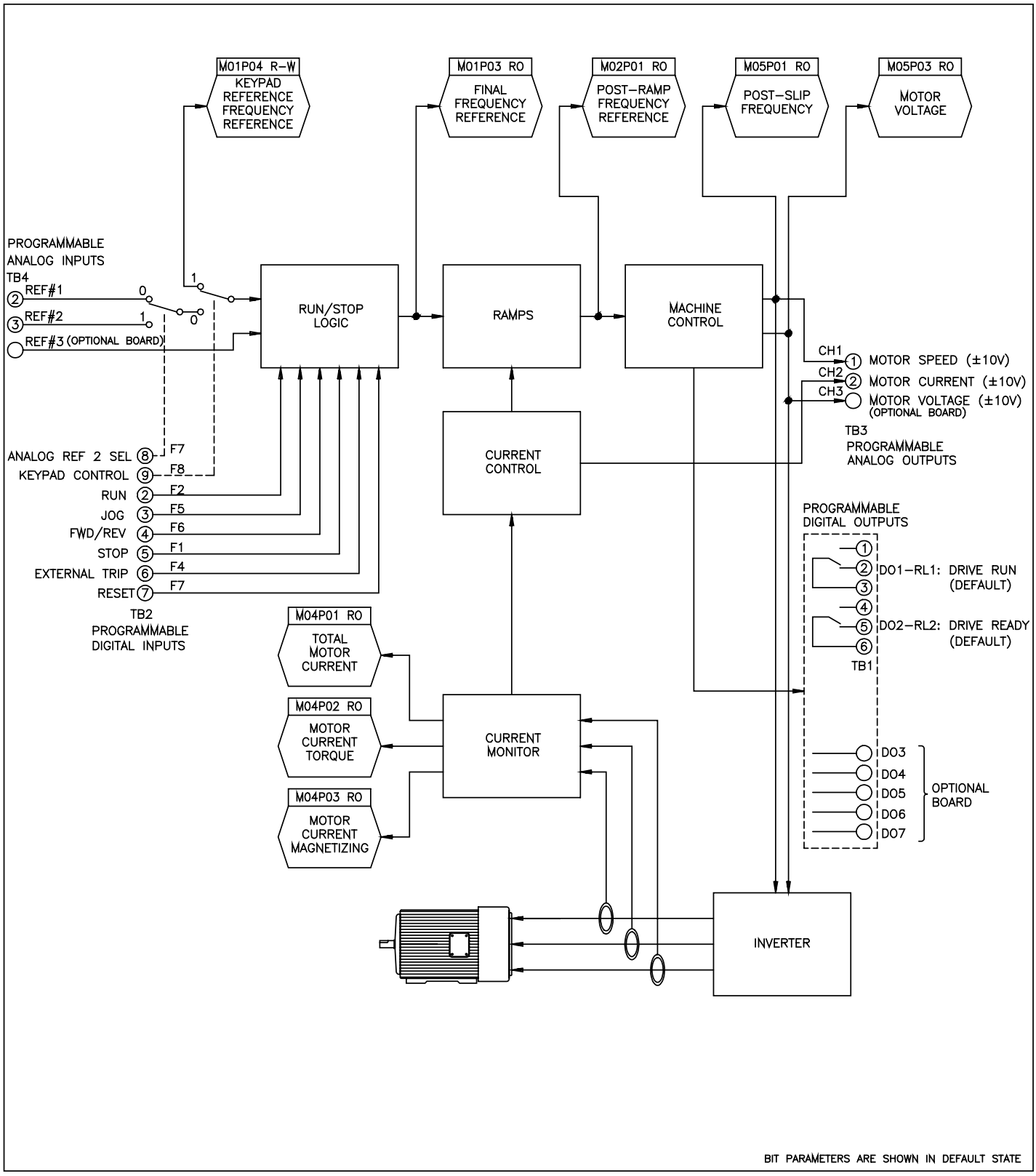


Figure 4-1
Basic Structure of the Control System

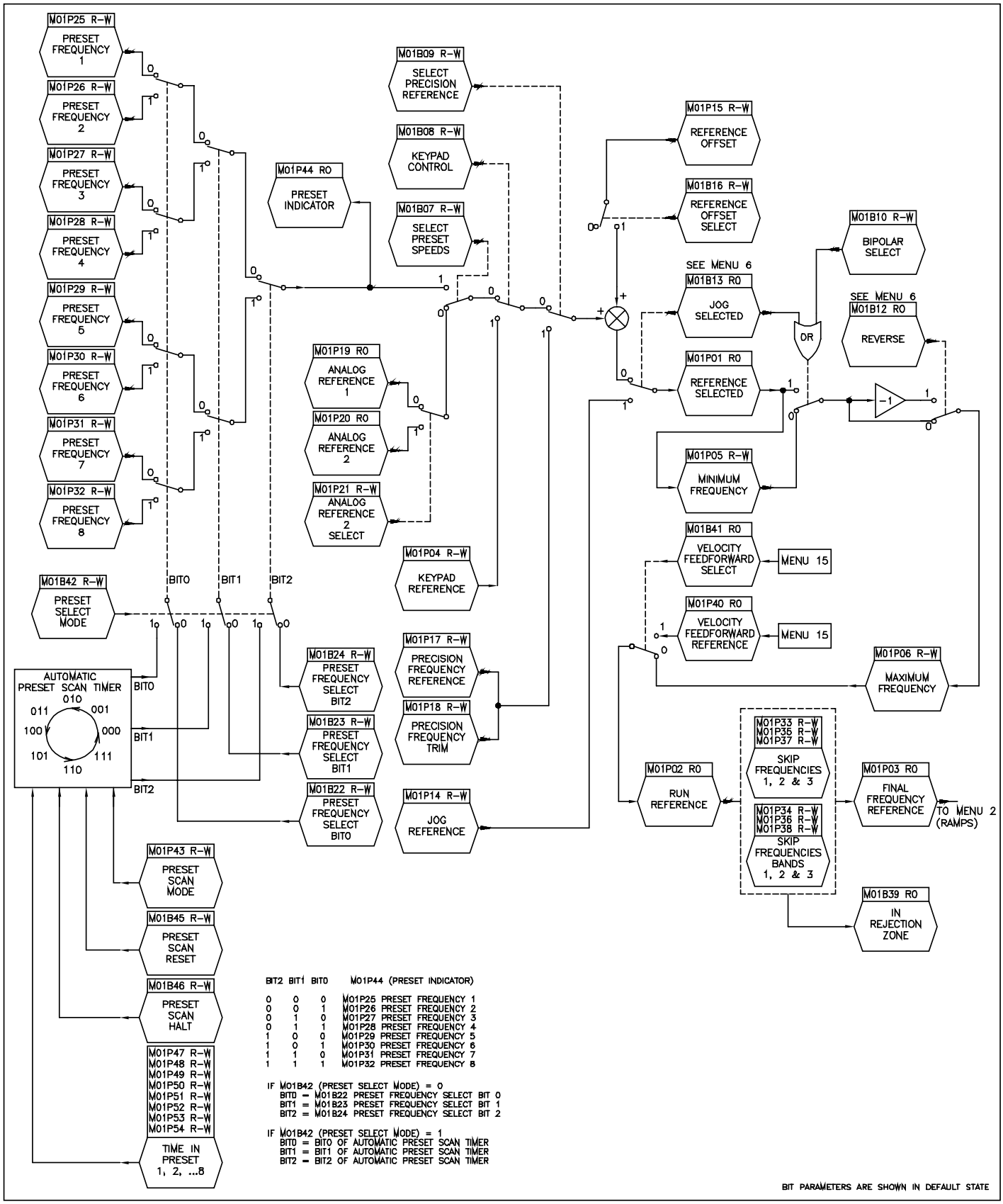


Figure 4-2
Menu 1 - Frequency Reference, Limits and Filters.

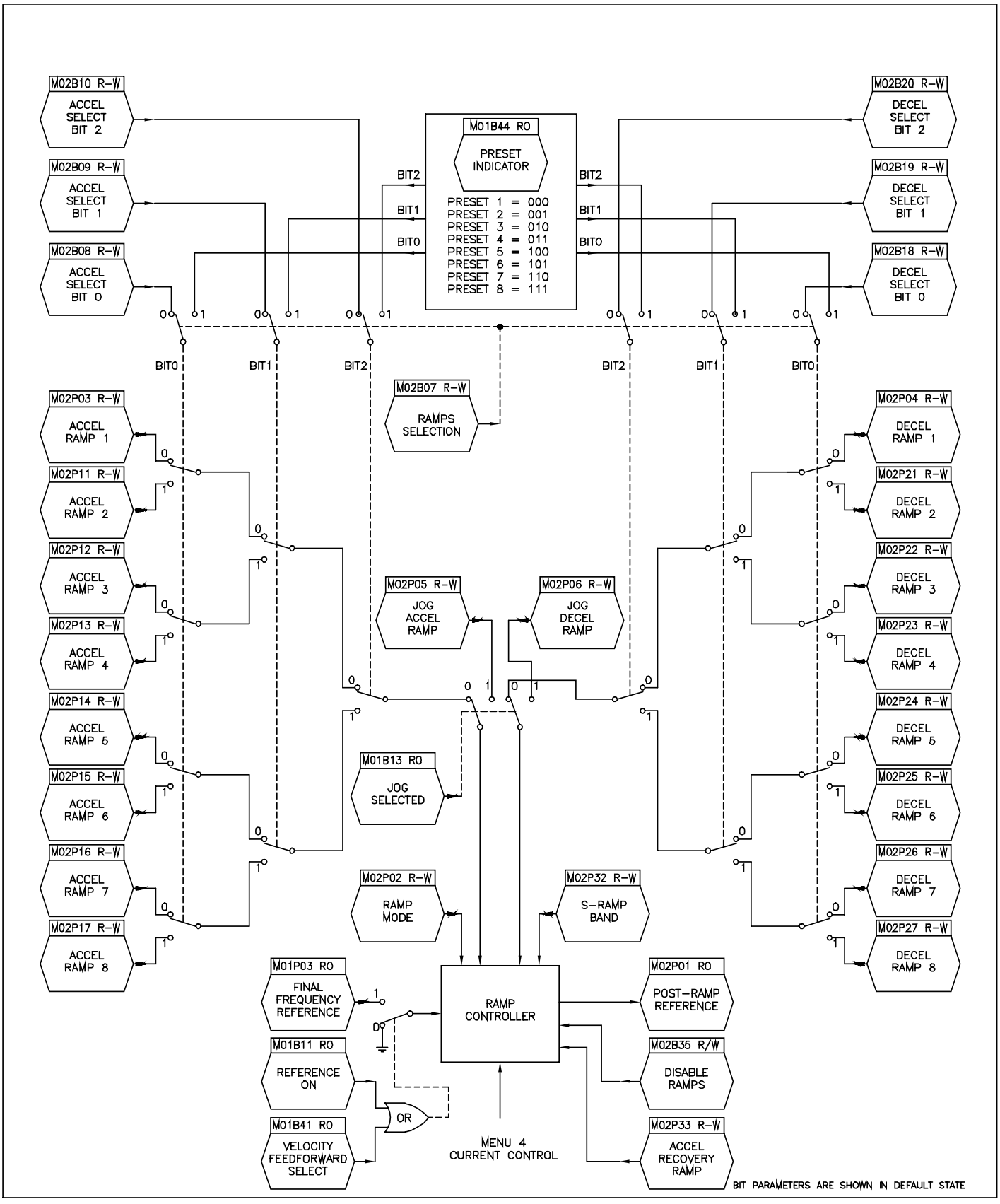


Figure 4-3
Menu 2 - Ramps

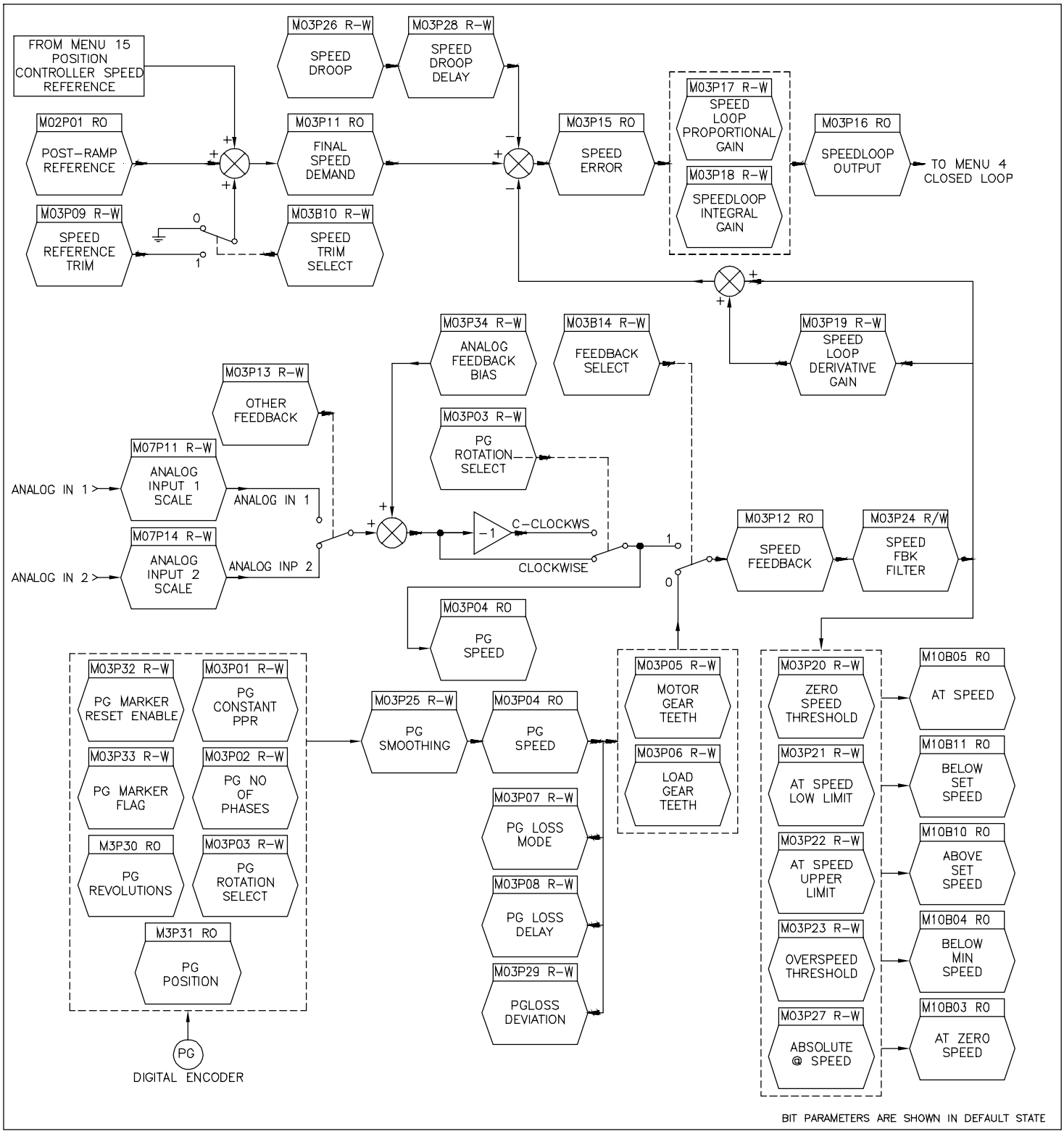


Figure 4-4
Menu 3 - Speed Input and Speed Loop

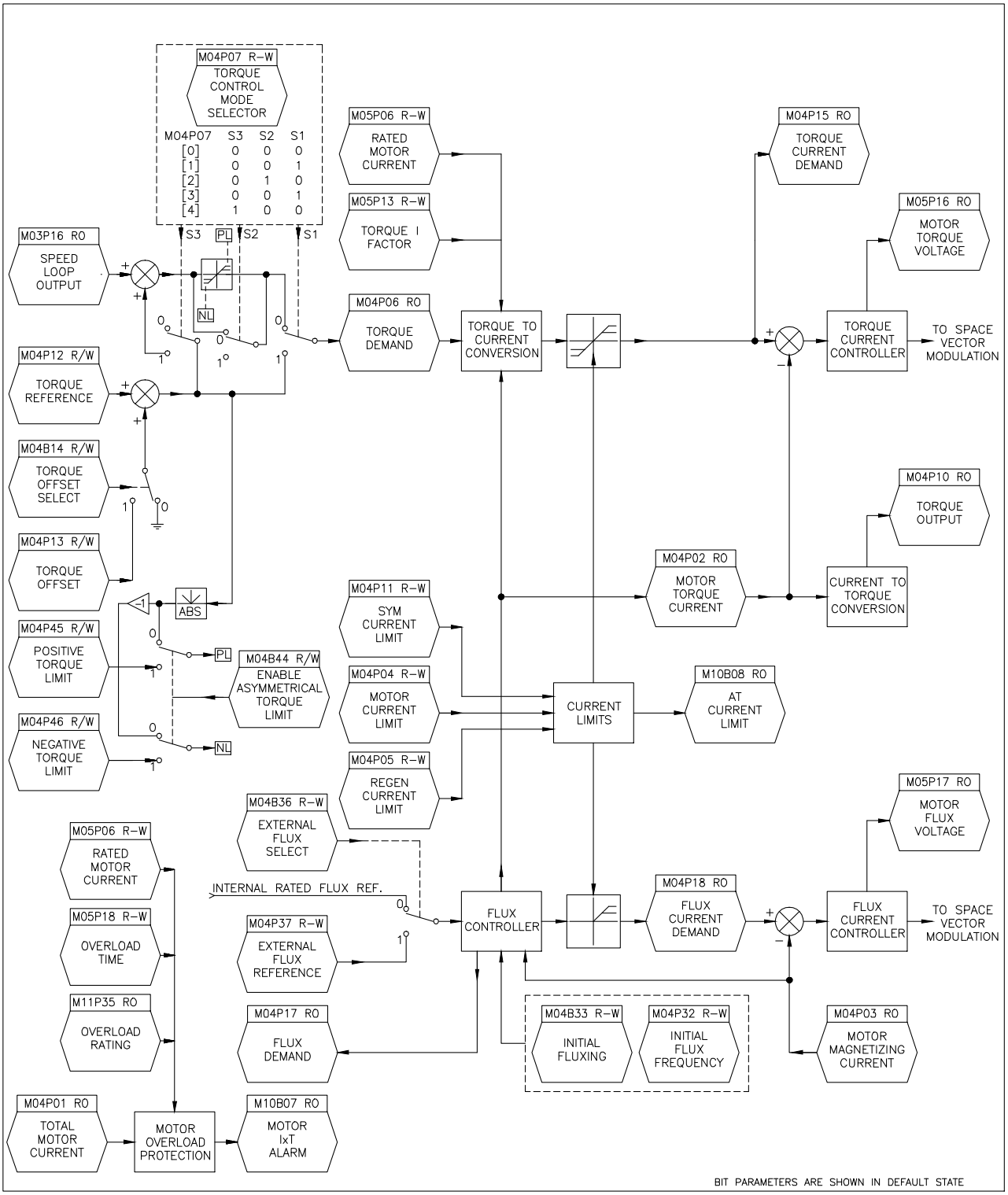


Figure 4-5
Menu 4 - Current Limits, Torque & Flux Control

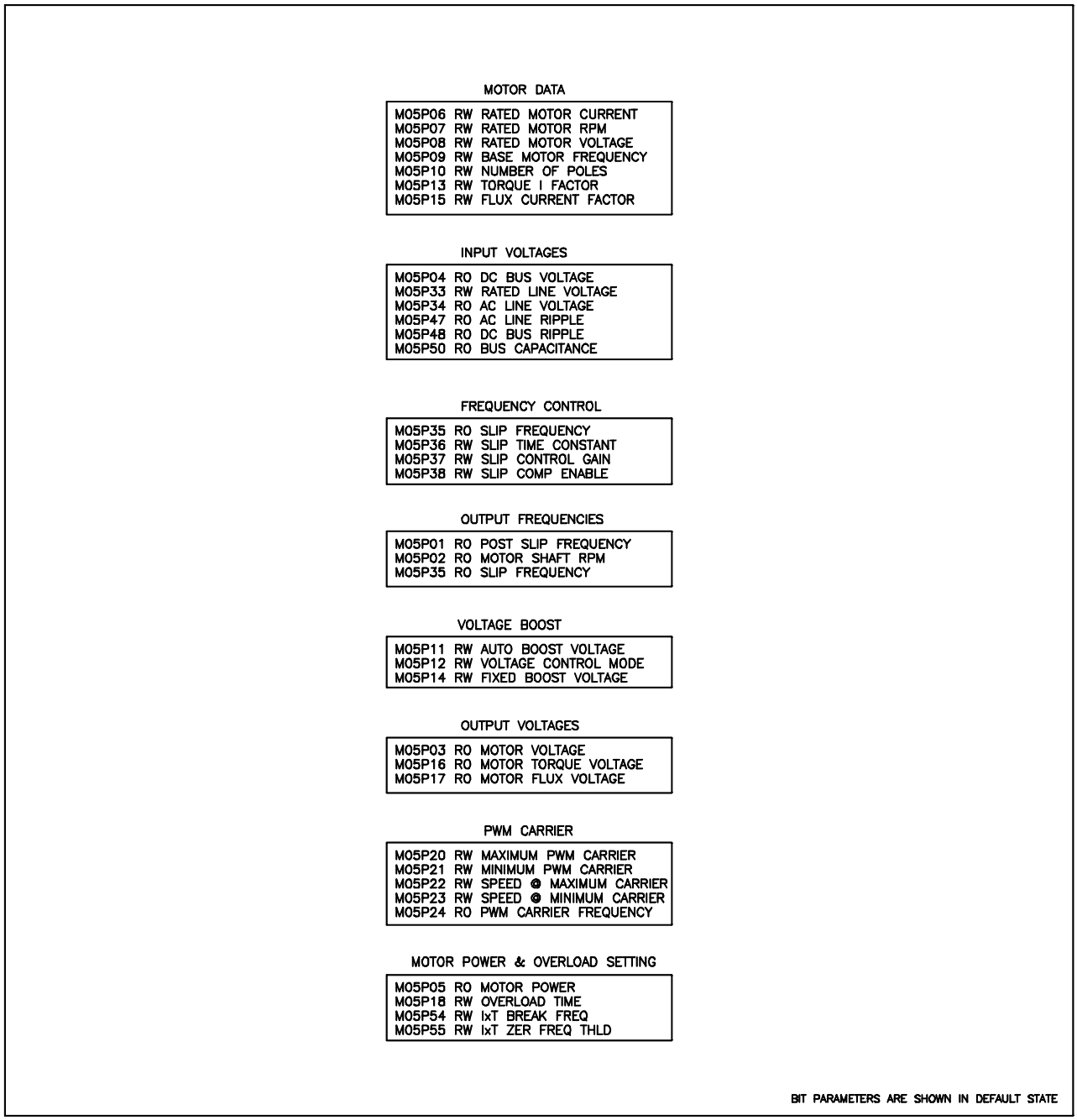


Figure 4-6
Menu 5 - Motor Control

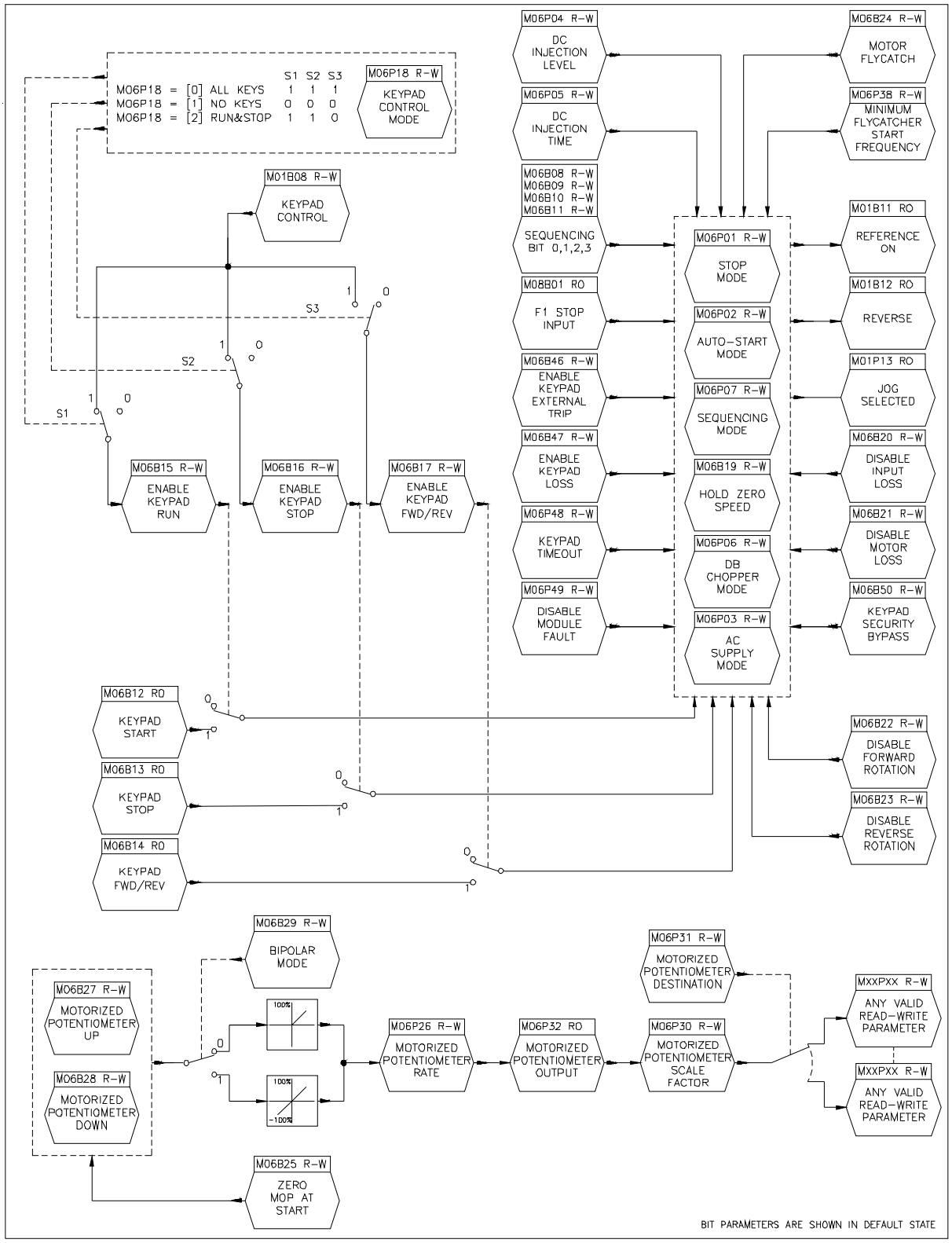


Figure 4-7
Menu 6 - Operational Modes

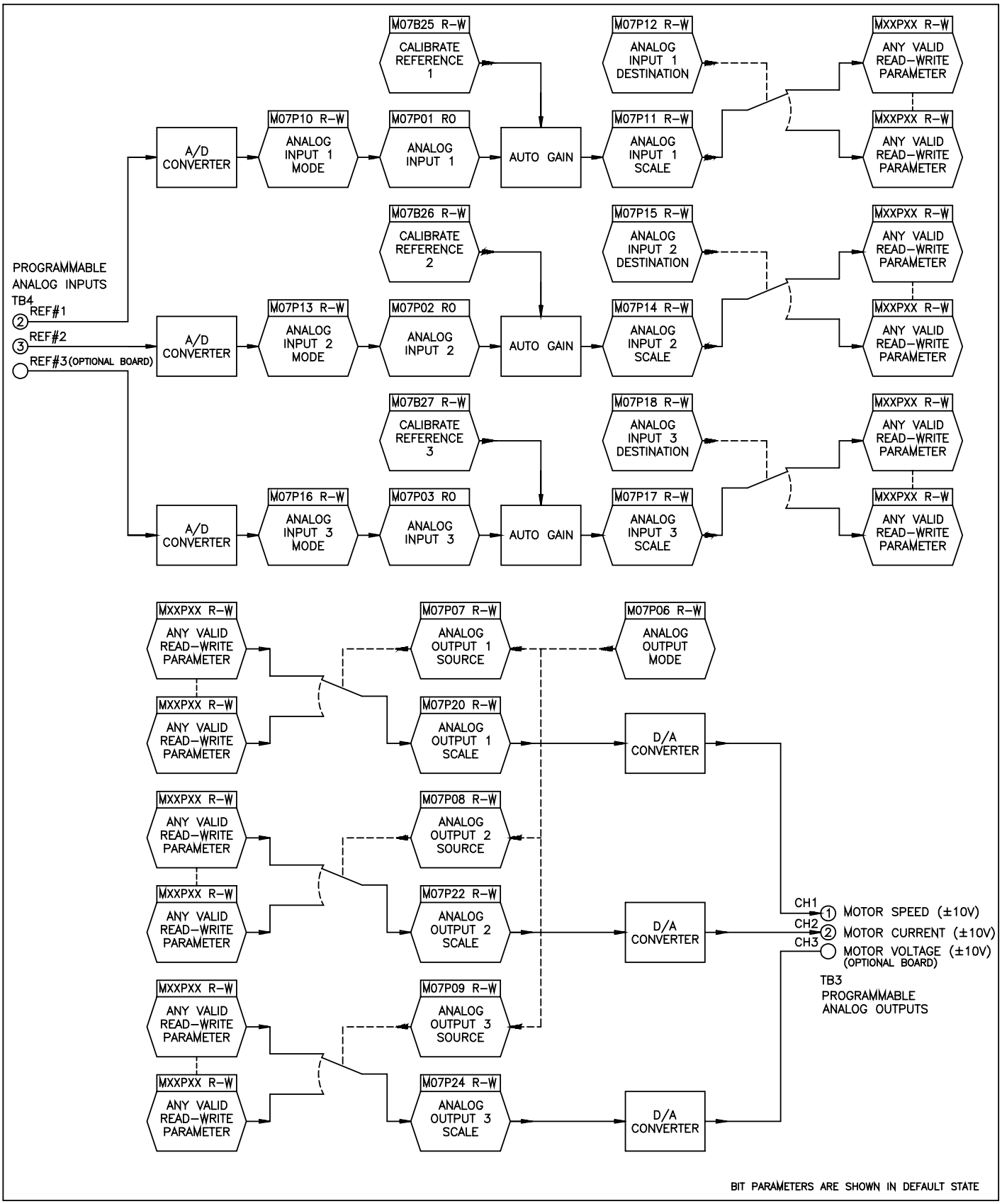


Figure 4-8
Menu 7 - Analog Inputs and Outputs.

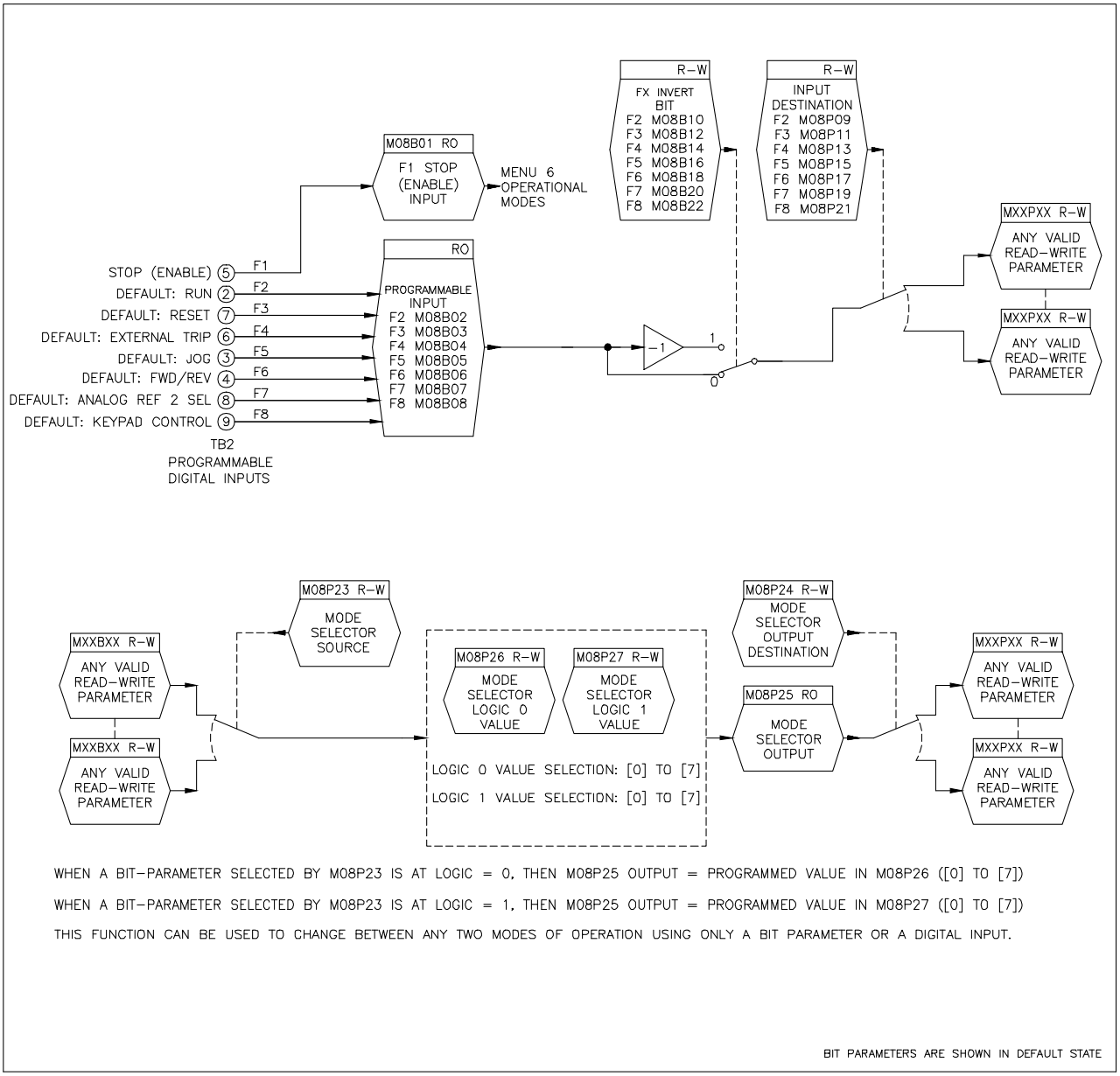


Figure 4-9
Menu 8 - Programmable Digital Inputs and Mode Selector.

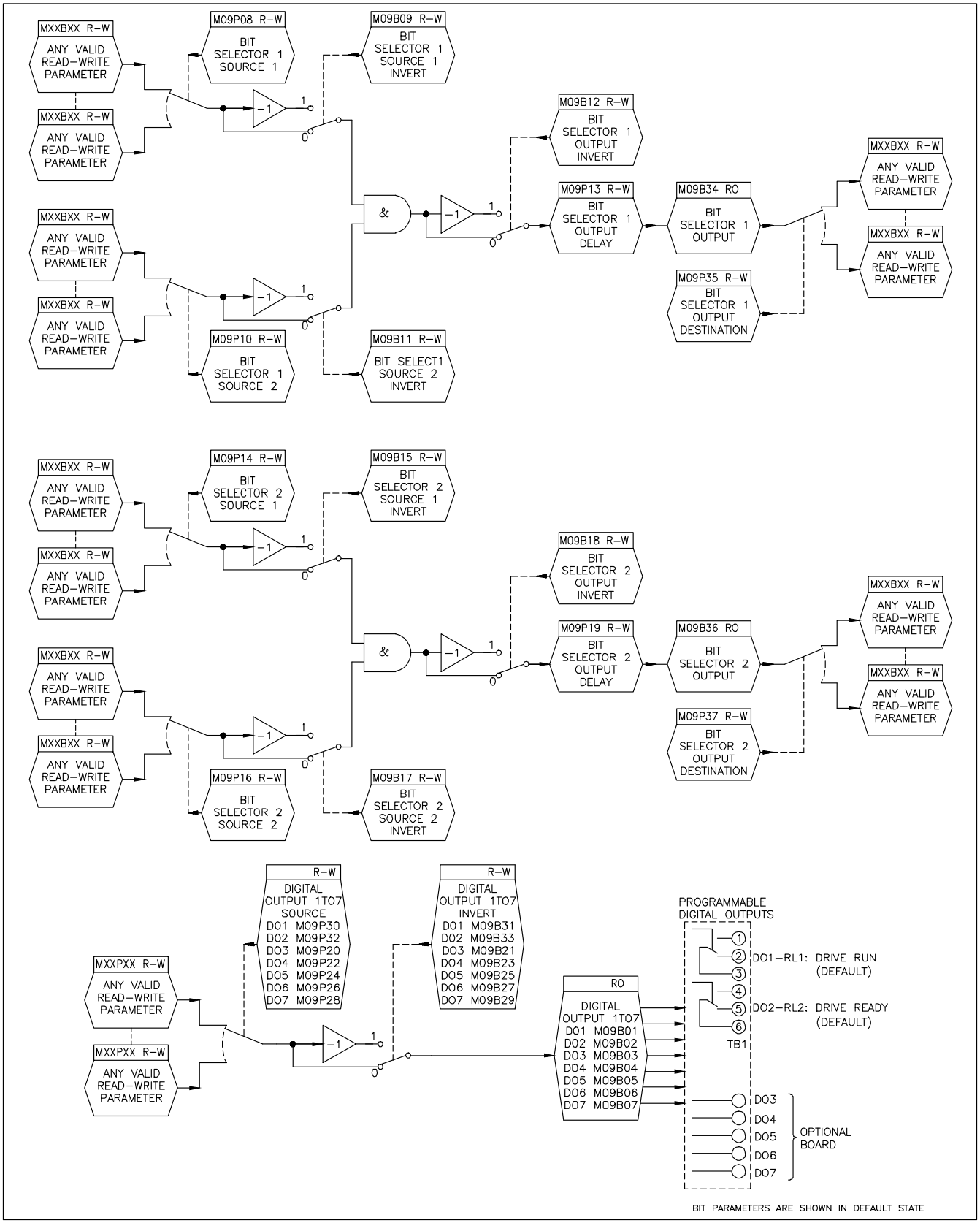


Figure 4-10
Menu 9 - Programmable Digital Outputs and Bit Selector

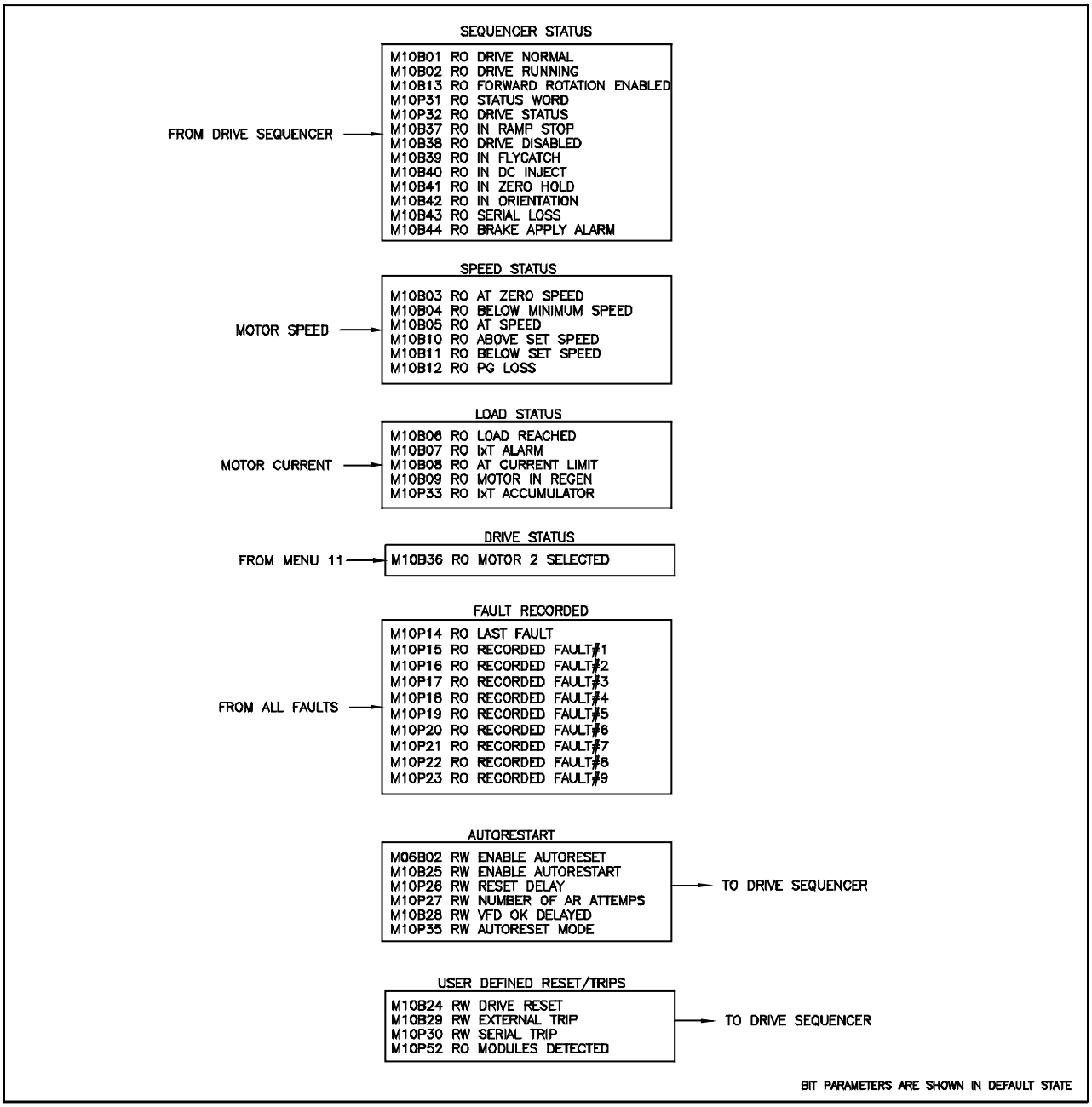


Figure 4-11
Menu 10 - Status Logic and Diagnostic Information

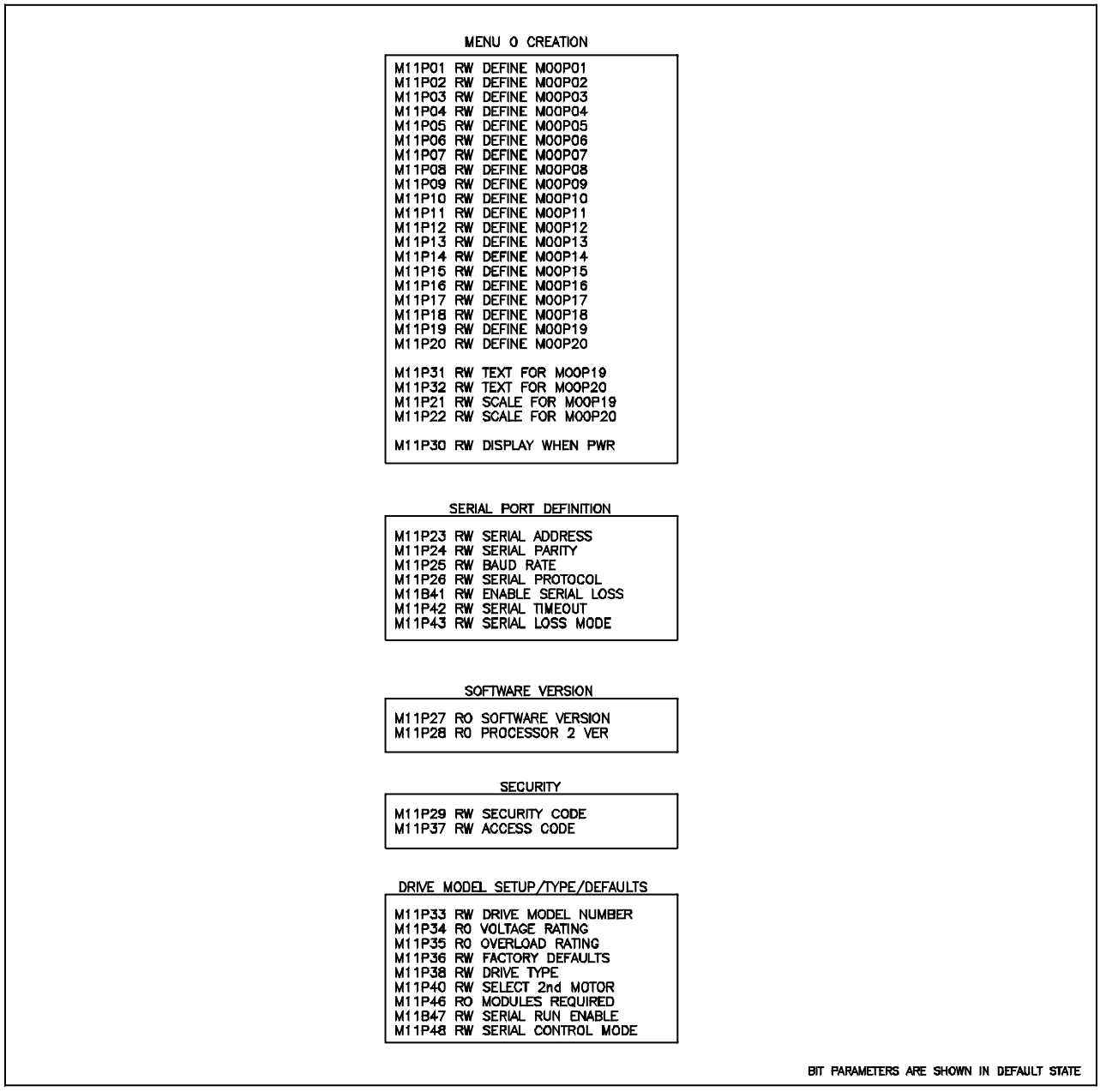


Figure 4-12
Menu 11 - Miscellaneous

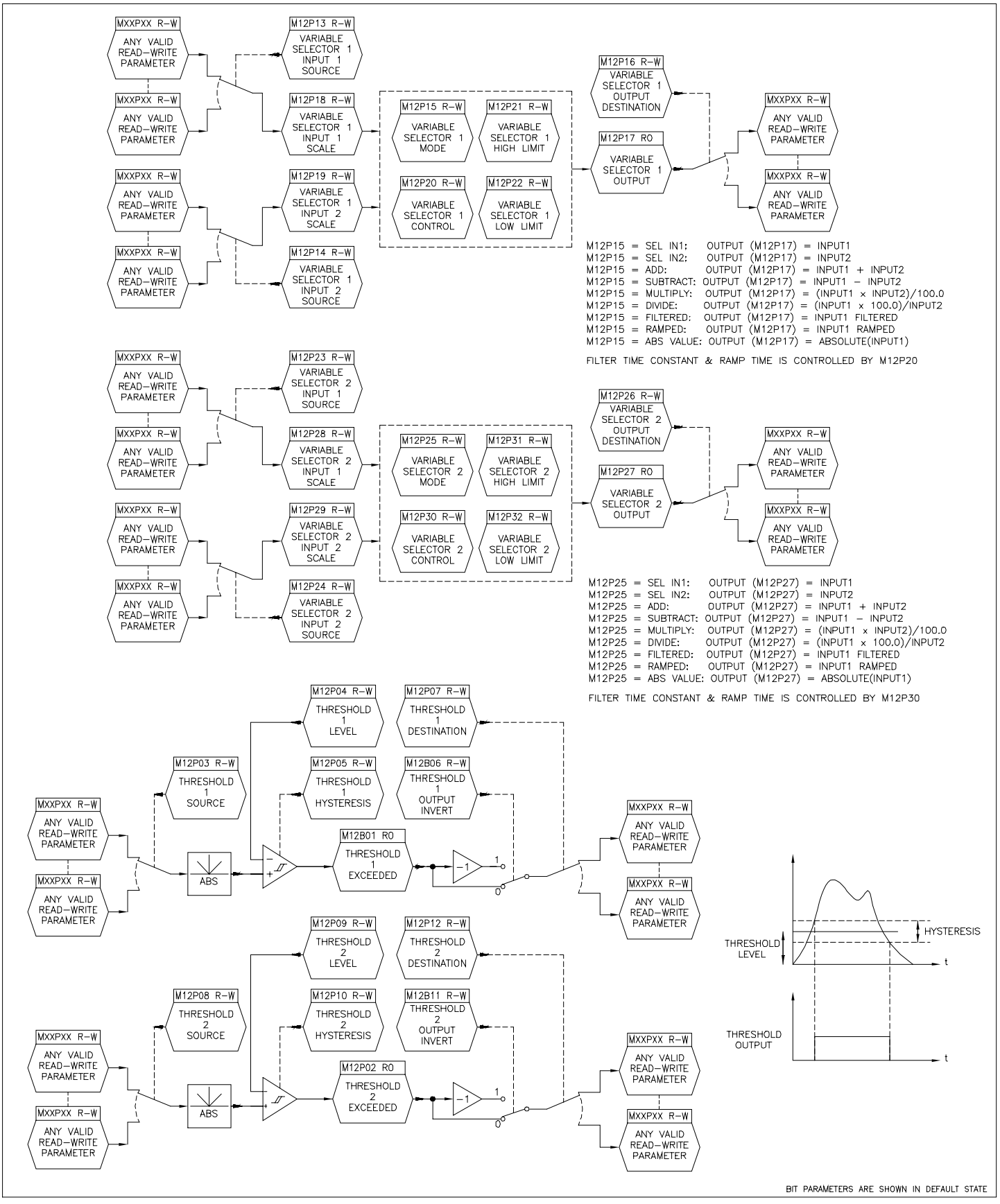


Figure 4-13
Menu 12 - Programmable Thresholds and Variable Selectors (1 of 5)

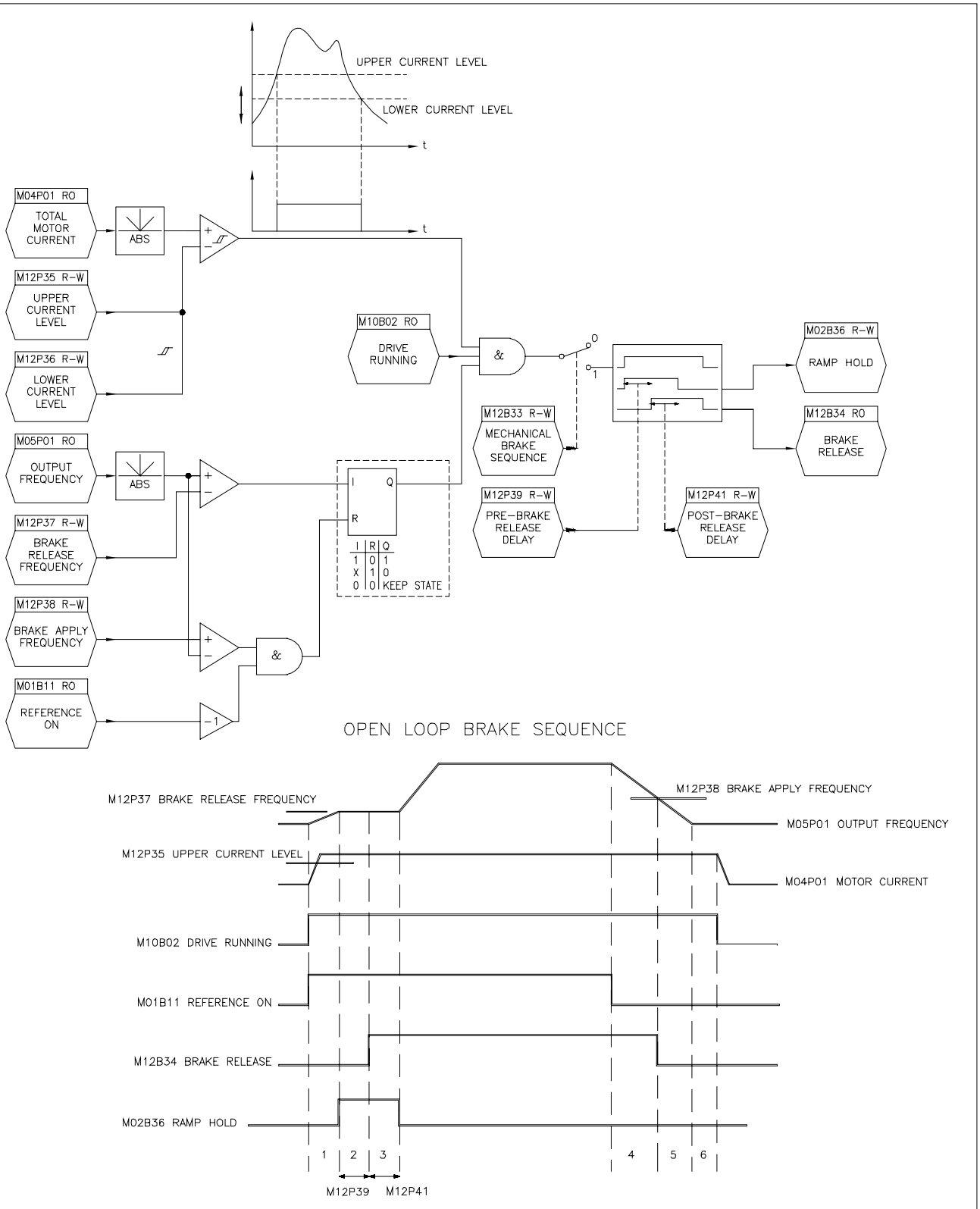


Figure 4-14
Menu 12 - Open-Loop Brake Function (2 of 5)

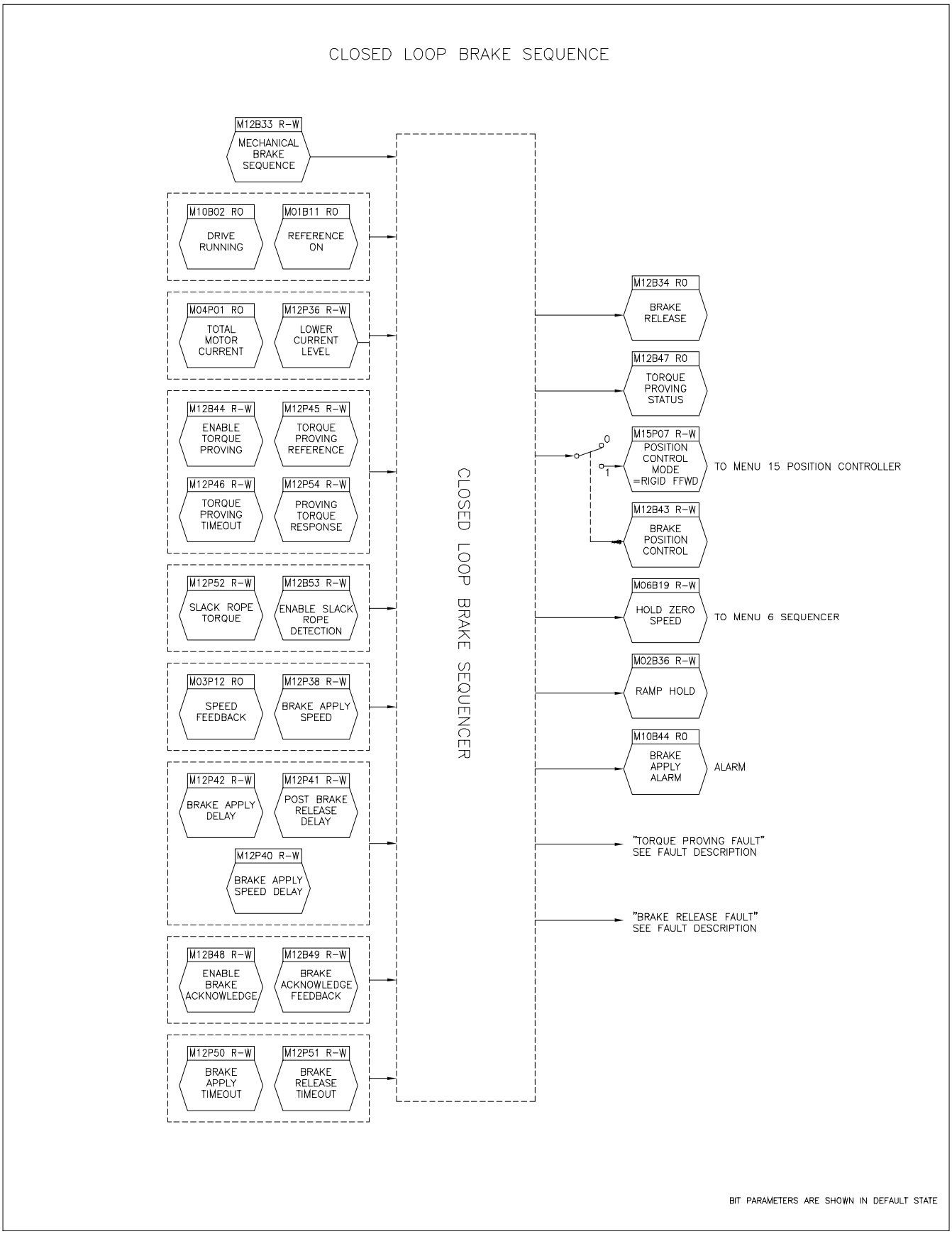


Figure 4-15
Menu 12 - Closed-Loop Brake Function (3 of 5)

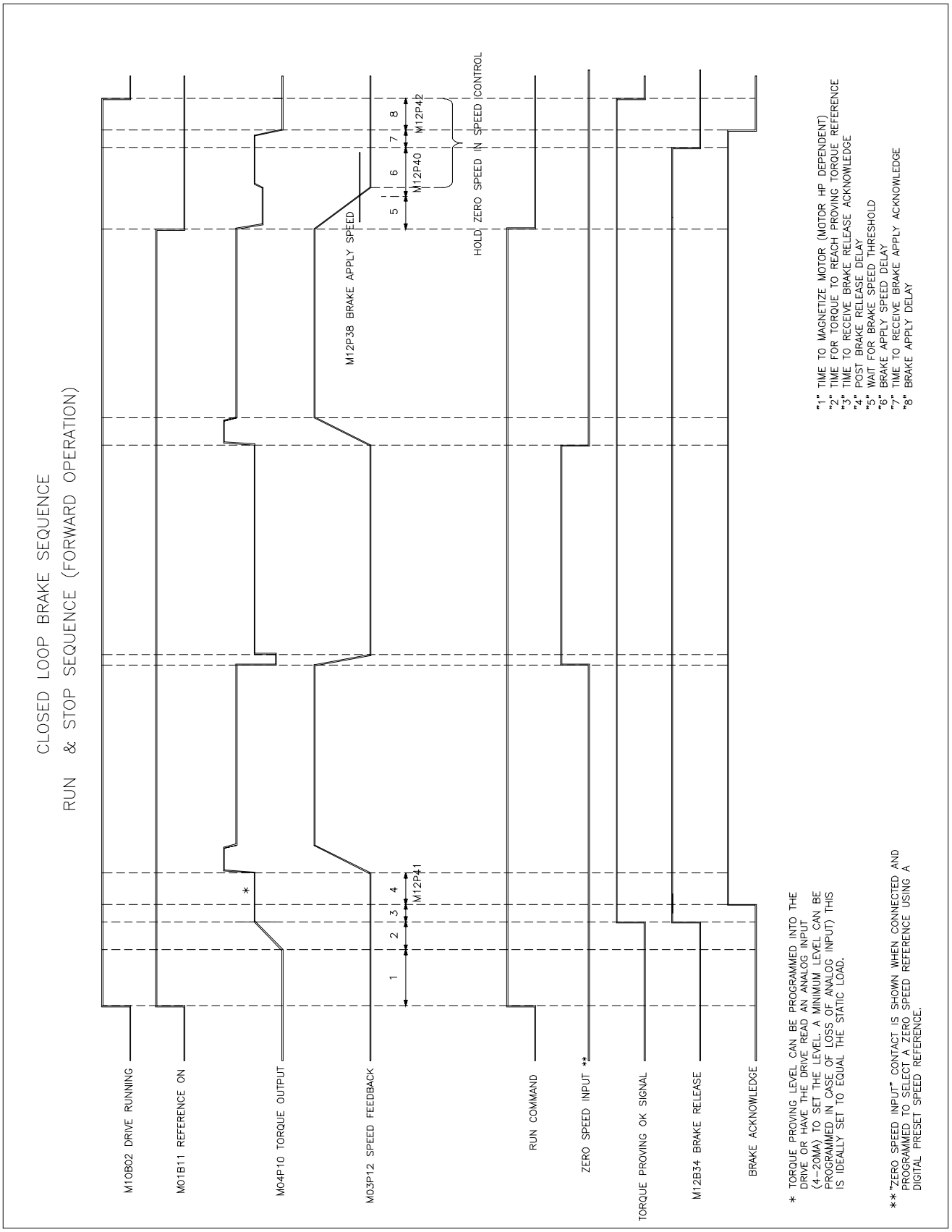


Figure 4-16
Menu 12 - Closed-Loop Brake Function (4 of 5)

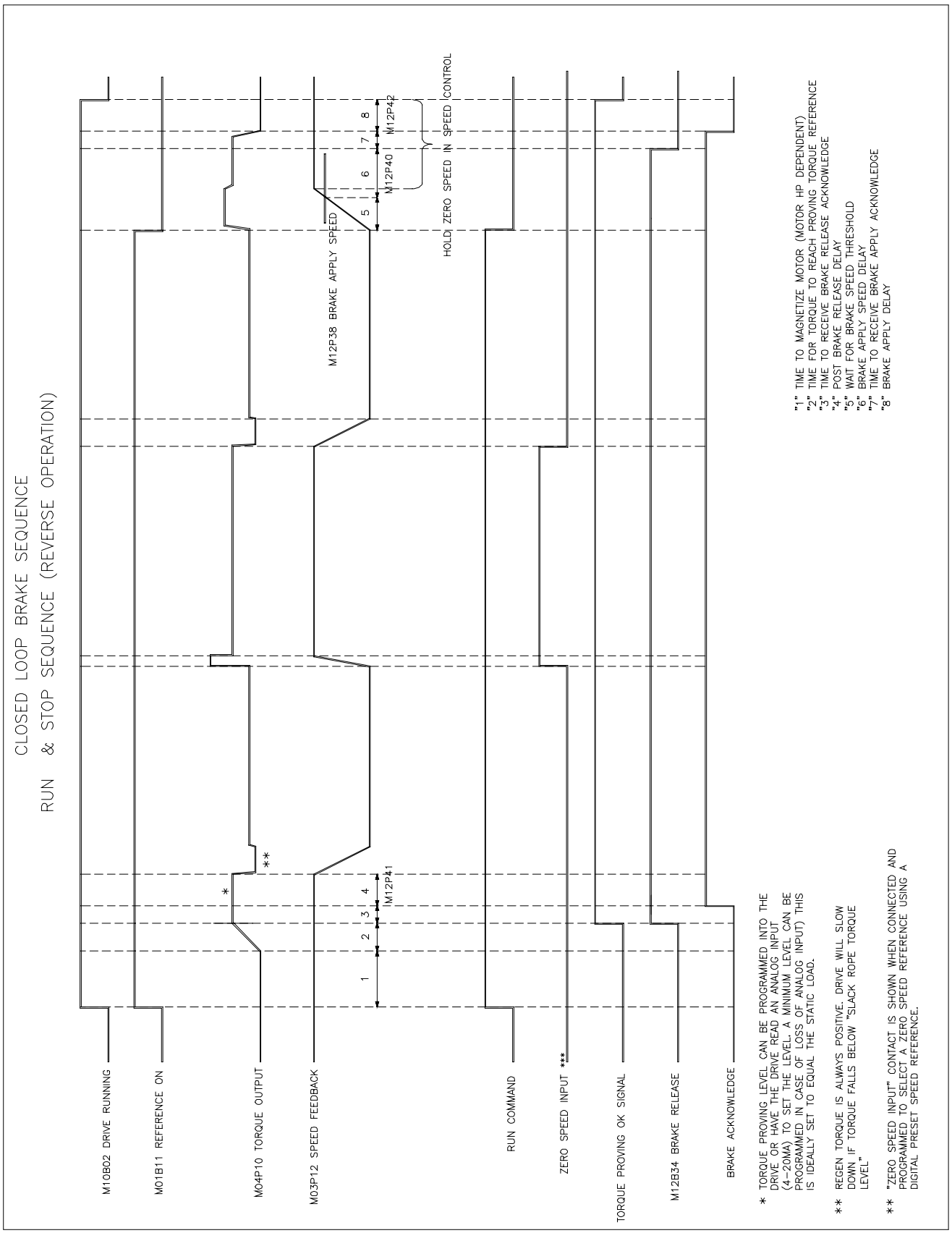


Figure 4-17
Menu 12 - Closed-Loop Brake Function (5 of 5)

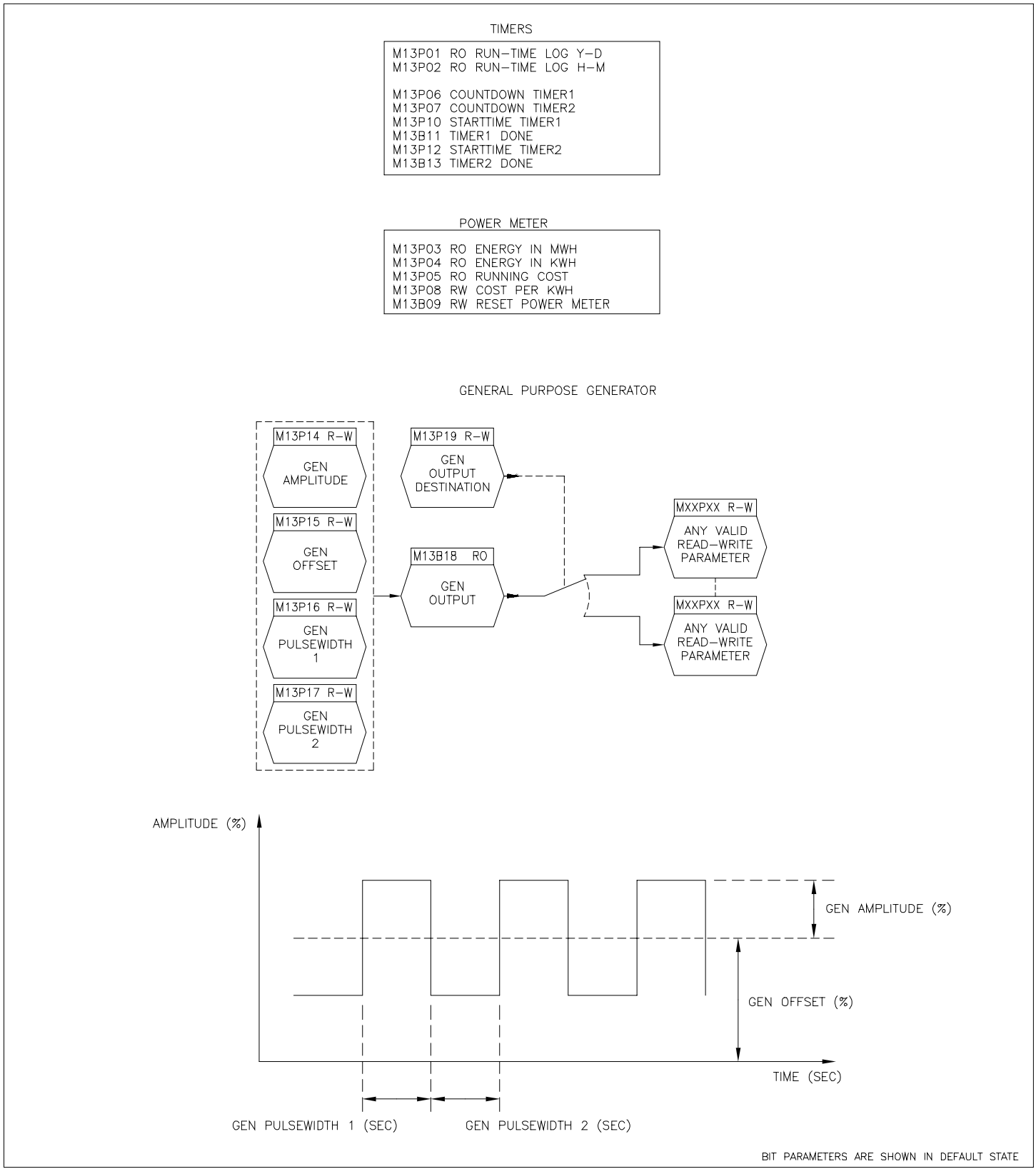


Figure 4-18
Menu 13 - Timers Function & General Purpose Generator

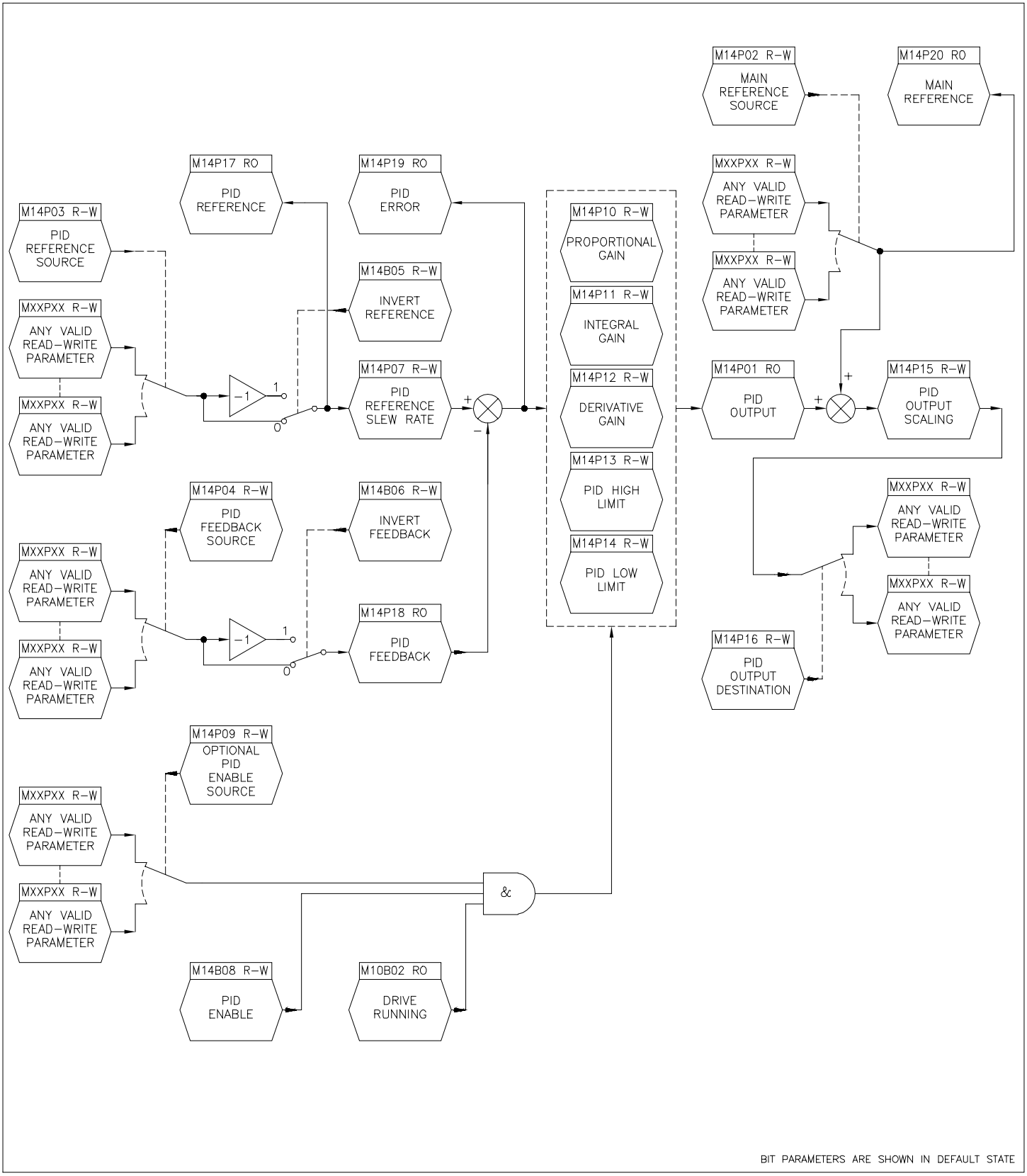


Figure 4-19
Menu 14 - PID Control Loop.

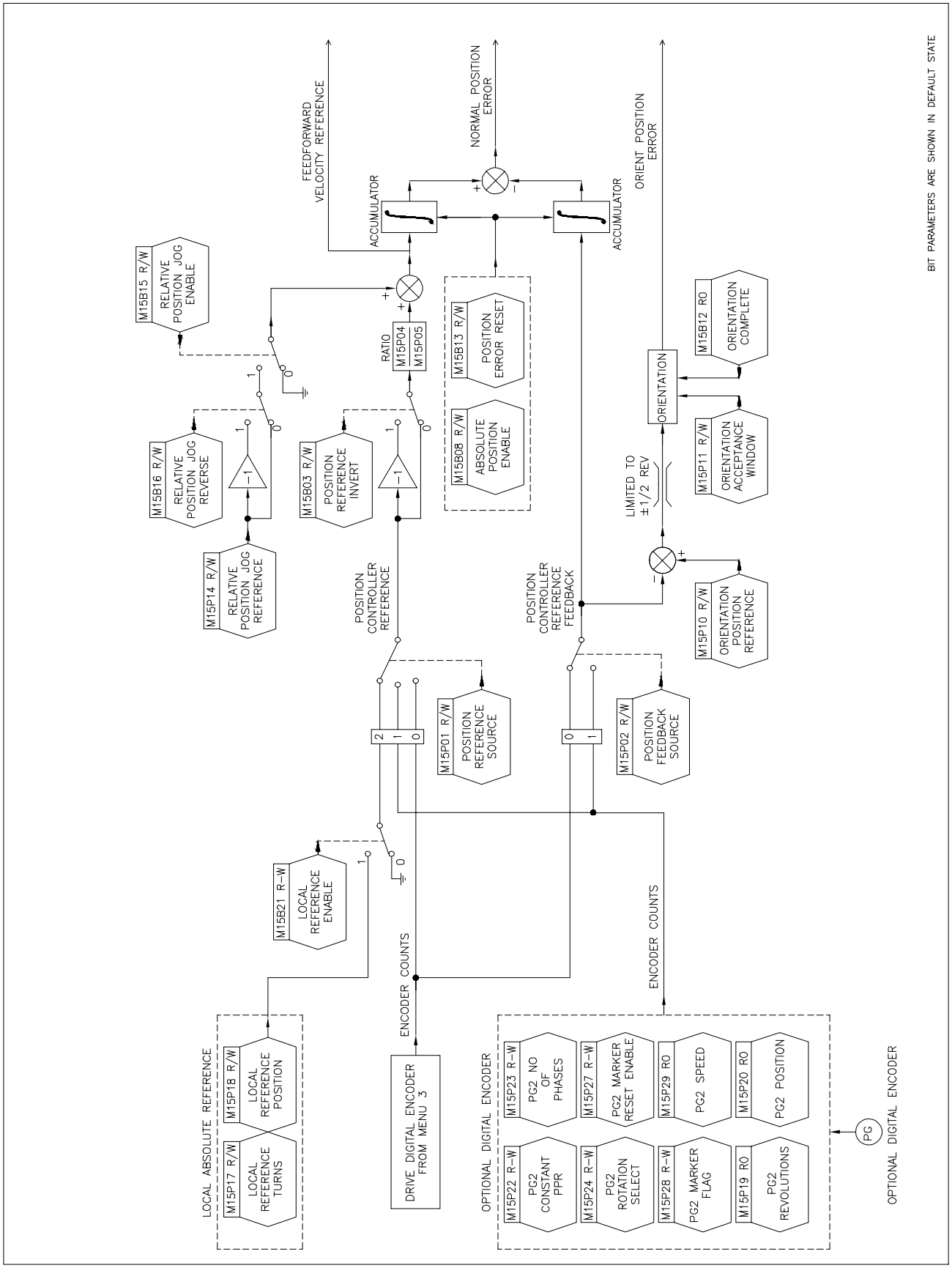


Figure 4-20
Menu 15 - Position Control (1 of 2)

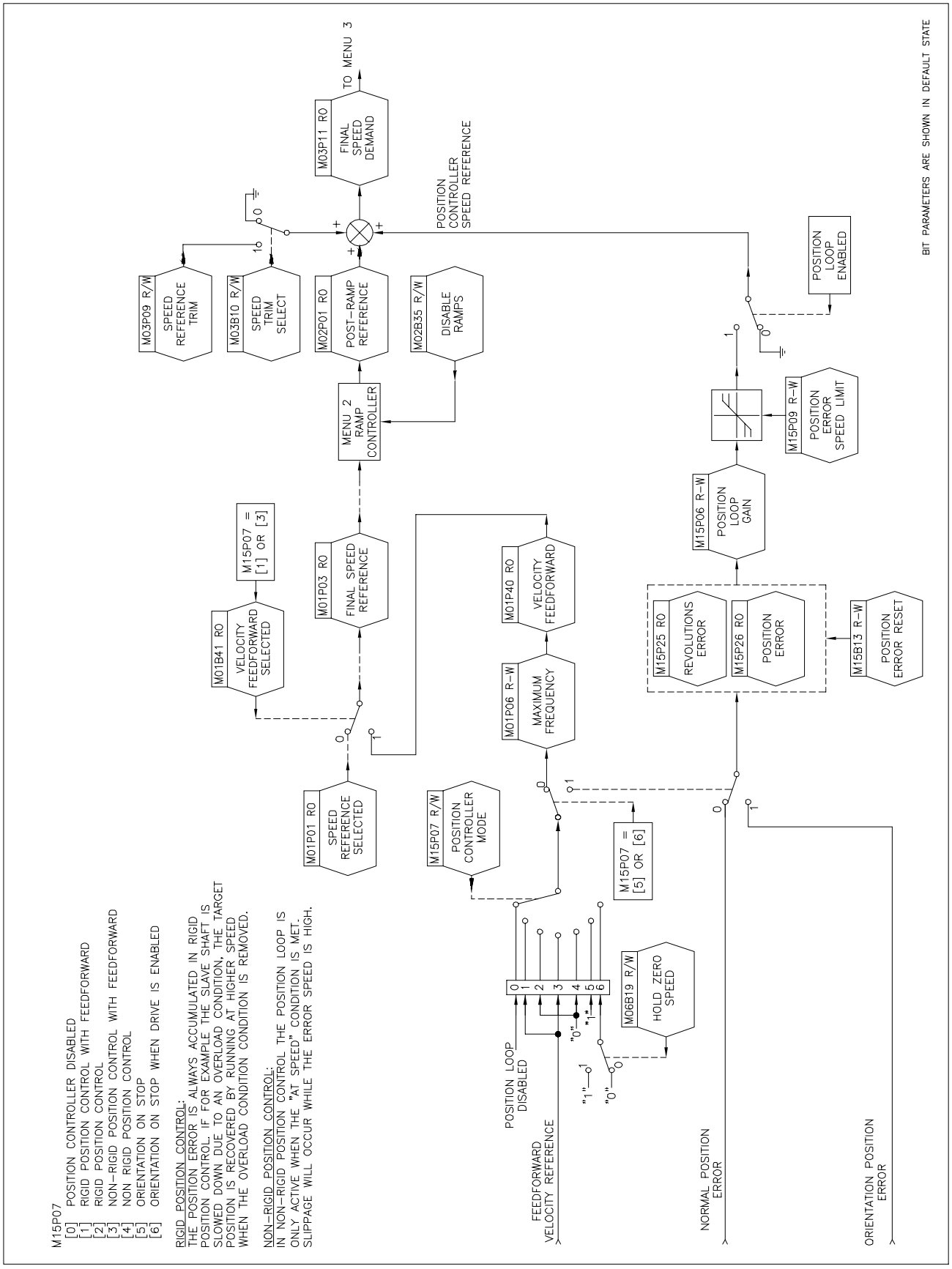


Figure 4-21
Menu 15 - Position Control (2 of 2)

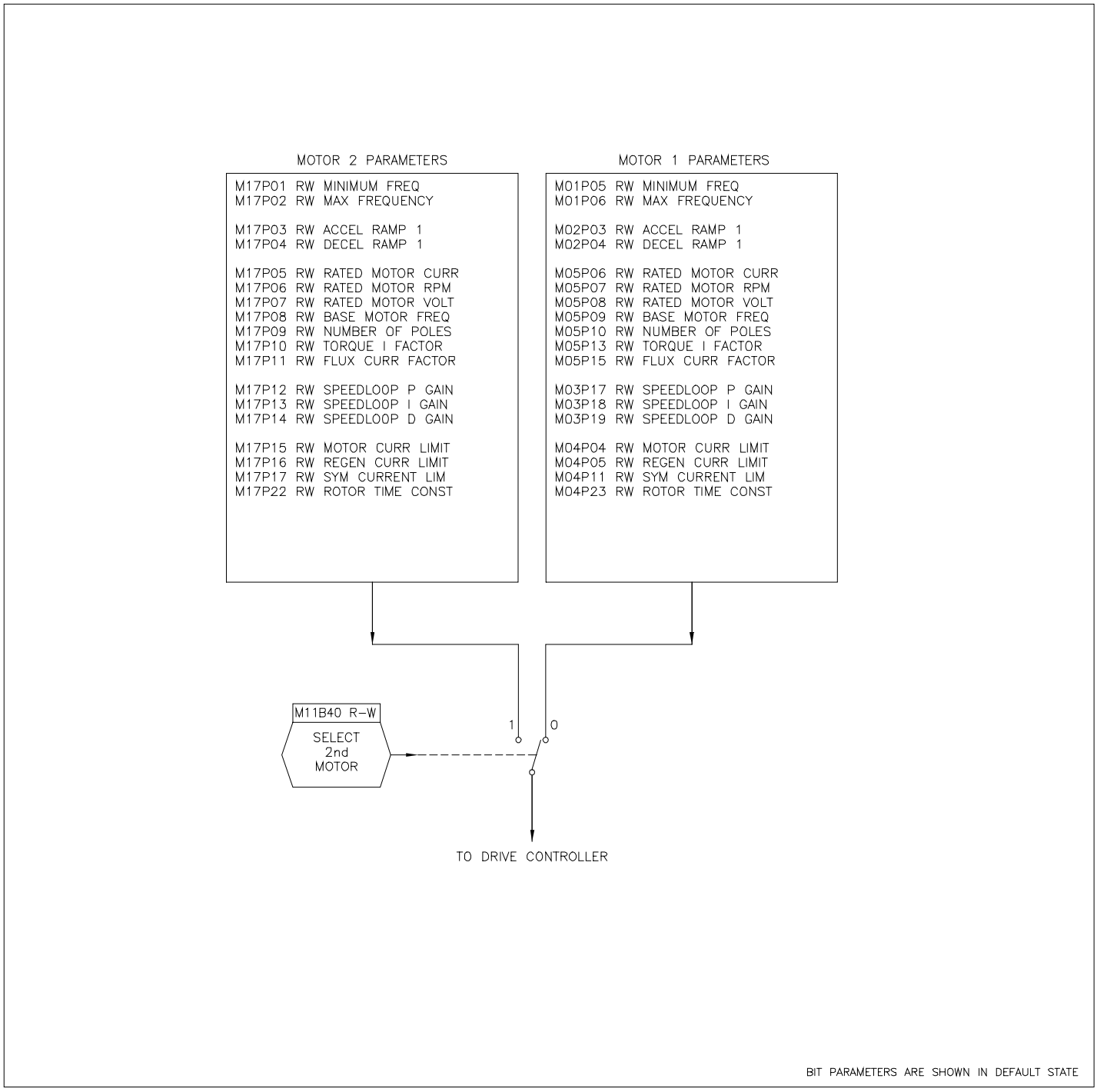


Figure 4-22
Menu 17 - 2nd Motor Parameters

4.2 Parameter Definitions

MXXP00	Parameter 00 is at the beginning of every menu and it is also the menu name: M00P00 QUICK SET UP MENU M01P00 FREQ REFS MENU M02P00 RAMPS MENU M03P00 ENCODER MENU M04P00 CURR-TORQUE CTRL M05P00 MOTOR CONTROL M06P00 OPERATION MODES M07P00 ANALOG I/O MENU M08P00 DIG INS-MODE SEL M09P00 DIG OUTS-BIT SEL M10P00 STATUS-DIAGNOSTIC M11P00 MISCELLANEOUS M12P00 THRESHOLDS-VARSEL M13P00 TIMERS/GENERATOR M14P00 PID CONTROL LOOP M15P00 POSITION CONTROL M17P00 2nd MOTOR PARAMS	R-O	Range: Default:
M00P01 (M05P08)	**RATED MOTOR VOLT** Enter the value from the motor rating plate in order to define the maximum output voltage of the drive. This parameter assumes the R-W or R-O attribute of the parameter assigned to it.	R-W	Range: 100 to 600 VRMS Default: 240 480 600
M00P02 (M05P09)	**BASE MOTOR FREQ** Enter a value of frequency at which the rated voltage is to be applied to the motor. The motor then enters the constant-power or field-weakening region. This parameter assumes the R-W or R-O attribute of the parameter assigned to it.	R-W	Range: 10.0 to 600.0 Hz Default: 60.0
M00P03 (M05P06)	**RATED MOTOR CURR** When parameter M05P06 is set at a value lower than the default rating of the drive, the maximum current of the drive can be greater than 1.5 times the motor rating. Consequently, the maximum value of current limit and torque parameters (M04P04, M04P05, M04P06, M04P11 and M06P04) can be increased proportionately. For example, if a 180 Amp drive has parameter M05P06 set at 90 Amps, the maximum values of parameters M04P04, M04P05, M04P11 and M06P04 can be 300% (2 x 150%). This allows larger drives to be used for a high starting torque. When the value is increased beyond the default value of M05P06, the values of M04P04, M04P05 and M04P11 are automatically decreased. The value entered affects the following: Slip compensation Dynamic V/f Ixt detection level	R-W	Range: 0 to 1800 A Default: Model Dependent

	Industrial and HVAC applications Industrial applications benefit from a higher percentage of overload current, but have a lower nominal current. HVAC applications benefit from a higher nominal current, but have a lower percentage of overload current (120%). The overload current has the same value in each case. See parameter M05P18. This parameter assumes the R-W or R-O attribute of the parameter assigned to it.		
M00P04 (M05P10)	**NUMBER OF POLES** Enter the value from the motor rating plate for correct slip compensation and RPM indication. This parameter assumes the R-W or R-O attribute of the parameter assigned to it.	R-W	Range: [0] (2 POLES) to [15] (32 POLES) Default: [1] (4 POLES)
M00P05 (M04P11)	**SYM CURRENT LIM** After having set the required value of maximum current in M05P06, you may increase or decrease the percentage overload current using M04P11. The maximum percentage that can be set is limited by the overload current rating of the drive. The limit applies when motoring and regenerating. The value of M04P11 is automatically reduced when the value of M05P06 is increased beyond the default value. This parameter assumes the R-W or R-O attribute of the parameter assigned to it.	R-W	Range: See M04P04 % Default: 120 or 150 minimum
M00P06 (M02P03)	**ACCEL RAMP 1** Acceleration ramp rate is expressed as the time for the output frequency to increase by 100Hz. For example, a programmed ramp time of 5 seconds causes the frequency to increase or decrease by 50Hz in 2.5 seconds. This parameter assumes the R-W or R-O attribute of the parameter assigned to it.	R-W	Range: 0.1 to 3276 s/100Hz Default: Size 0: 30.0 sec Size 1: 30.0 sec Size 2: 60.0 sec Size 3: 60.0 sec
M00P07 (M02P04)	**DECEL RAMP 1** Deceleration ramp rate is expressed as the time for the output frequency to decrease by 100Hz. This parameter assumes the R-W or R-O attribute of the parameter assigned to it.	R-W	Range: 0.1 to 3276 s/100Hz Default: Size 0: 30.0 sec Size 1: 30.0 sec Size 2: 60.0 sec Size 3: 60.0 sec
M00P08 (M01P06)	**MAX FREQUENCY** Enter a value to define the absolute maximum output frequency. This parameter assumes the R-W or R-O attribute of the parameter assigned to it.	R-W	Range: 0 to 600.0 Hz Default: 60.0
M00P09 (M01P05)	**MINIMUM FREQ** Use in unipolar mode to define the minimum output frequency of the drive. This can be over-ridden by M01P06 and is inactive during Jog. This parameter assumes the R-W or R-O attribute of the parameter assigned to it.	R-W	Range: 0 to M01P06 Hz Default: 0

M00P10 (M05P33)	**RATED LINE VOLTS** Enter a value of voltage at which the rated voltage is to be applied to the input of the drive. This parameter assumes the R-W or R-O attribute of the parameter assigned to it.	R-W	Range: 200-250V for D2 Models 380-500V for D4 Models 500-600V for D5 Models Default: 240V for D2 Models 480V for D4 Models 575V for D5 Models
M00P11 (M11P27)	**SOFTWARE VERSION** Indicates version of software in the drive. This parameter assumes the R-W or R-O attribute of the parameter assigned to it.	R-O	Range: XXXX Default:
M00P12 (M11P33)	**DRIVE MODEL NO** Indicates the drive model number. This parameter assumes the R-W or R-O attribute of the parameter assigned to it.	R-W	Range: Default:
M00P13 (M05P03)	**MOTOR VOLTAGE** Indicates the RMS voltage applied to the motor. This parameter assumes the R-W or R-O attribute of the parameter assigned to it.	R-O	Range: 0 to M05P08 VRMS Default:
M00P14 (M05P05)	**MOTOR POWER** Indicates the real component of the power output. This parameter assumes the R-W or R-O attribute of the parameter assigned to it.	R-O	Range:0 to $\pm$ M05P03 $\times$ M11P35 $\times \frac{\sqrt{3}}{1000}$ KW Default:
M00P15 (M05P04)	**DC BUS VOLTAGE** Indicates the DC bus voltage. This parameter assumes the R-W or R-O attribute of the parameter assigned to it.	R-O	Range: 0 to 1000.0 V Default:
M00P16 (M05P34)	**AC LINE VOLTAGE** Indicates RMS voltage of the AC supply. This parameter assumes the R-W or R-O attribute of the parameter assigned to it.	R-O	Range: 0 to 1000.0 VRMS Default:
M00P17 (M10P14)	**LAST FAULT** This parameter assumes the R-W or R-O attribute of the parameter assigned to it.	R-O	Range: Default:
M00P18 (M04P01)	**MOT CURR-TOTAL** Indicates the magnitude of the total motor current. This parameter assumes the R-W or R-O attribute of the parameter assigned to it.	R-O	Range: 0 to ±M11P35 A Default:
M00P19 (M01P03)	**FINAL FREQ REF** Indicates the final frequency reference. This can be used for setting up the system and fault finding. This parameter is always read only (R-O)	R-O	Range: ±M01P06 Hz Default: 0.0
M00P20 (M05P02)	**MOTOR SHAFT RPM** Indicates motor shaft RPM. The number of poles must be entered correctly in M00P04 (M05P10), and the slip correction must not be at the maximum frequency limit [if the motor is to run at 60Hz, set M00P08 (M01P06) at a higher value to allow for slip compensation]. This parameter is always read only (R-O)	R-O	Range: 0 to 32760 RPM Default:

M01P01	**REF SELECTED** Indicates the frequency reference. This can be used for setting up the system and fault finding.	R-O	Range: ±1000.0 Hz Default:
M01P02	**RUN REFERENCE** Indicated the run frequency reference. This can be used for setting up the system and fault finding.	R-O	Range: ±M01P06 Hz Default: 0.0
M01P03	**FINAL FREQ REF** Indicates the final frequency reference. This can be used for setting up the system and fault finding.	R-O	Range: ±M01P06 Hz Default: 0.0
M01P04	**KEYPAD REFERENCE** Enter a value using the Control Keypad.	R-W	Range: Bipolar: ±M01P06 Hz Unipolar: M01P05 to M01P06 Default: 0
M01P05	**MINIMUM FREQ** Use in unipolar mode to define the minimum output frequency of the drive. This can be over-ridden by M01P06 and is inactive during Jog.	R-W	Range: 0 to M01P06 Hz Default: 0
M01P06	**MAX FREQUENCY** Enter a value to define the absolute maximum output frequency.	R-W	Range: 0 to 600.0 Hz Default: 60.0
M01B07	**SEL PRESET SPEED** Set at 1 to select pre-set speeds.	R-W	Range: 0 or 1 Default: 0
M01B08	**KEYPAD CONTROL** Set at 1 to select control using Keypad keys and Keypad reference, (it forces 1 into M06B15, M06B16, and M06B17 if M06B18 is set to "All Keys".	R-W	Range: 0 or 1 Default: 0
M01B09	**SEL PRECIS REF** Set at 1 for high resolution (0.001Hz) frequency control. Set at 0 for normal resolution (0.03Hz) frequency control.	R-W	Range: 0 or 1 Default: 0
M01B10	**BIPOLAR SELECT** Set at 1 to select bipolar speed reference signal. Set at 0 to select unipolar speed reference signal. Negative input signals are then treated as zero. <u>Analog Operation</u> When M01B10 is set at 0, any analog input programmed to parameters M01P19 and M01P20 is scaled so that 100% corresponds to the maximum set for M01P06, and 0% corresponds to the minimum set for M01P05. When M01B10 is set at 1, the analog input programmed to M01P19 or M01P20 is scaled so that ± 100% corresponds to the maximum ± set for M01P06. In addition, if an analog input programmed in voltage mode is directed to one of these parameters and the parameter is selected as the frequency reference, the scan-rate of the analog input is increased.	R-W	Range: 0 or 1 Default: 0

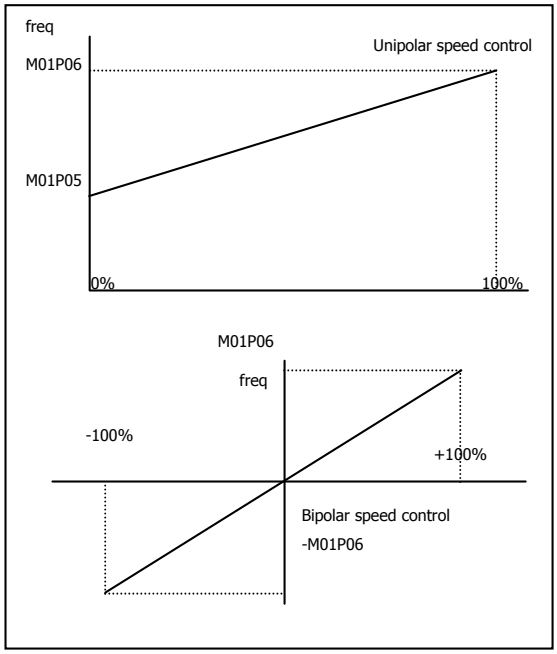
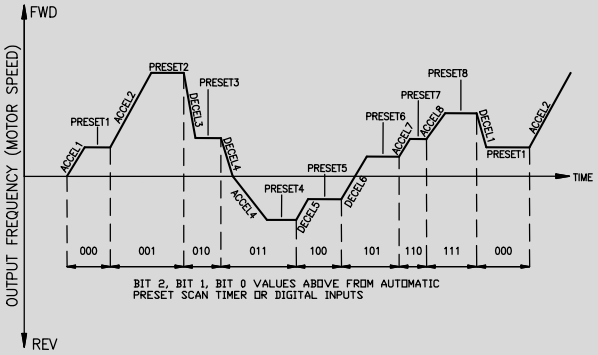
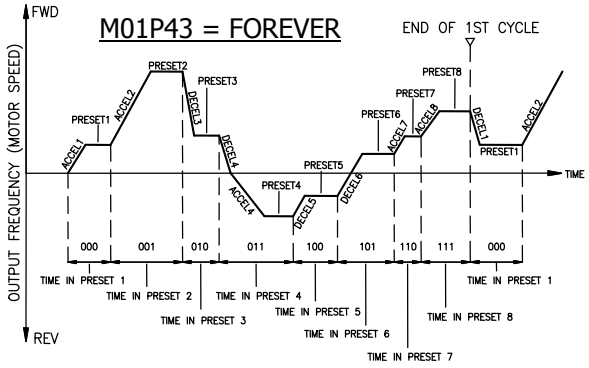
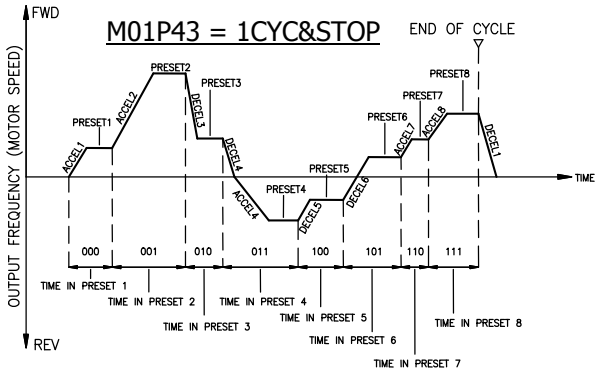


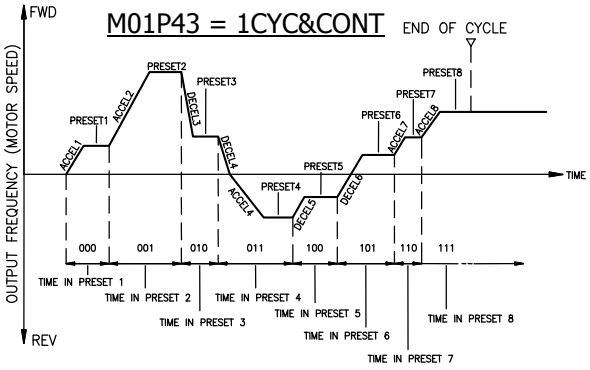
Figure 10-1 Scaling of the analog speed reference input

M01B11 **M01B12** **M01B13**	**REFERENCE ON** **REVERSE** **JOG SELECTED** These parameters are controlled by the drive sequencer.	R-O	Range: 0 or 1 Default: 0
M01P14	**JOG REFERENCE** Frequency reference for Jog.	R-W	Range: 0 to 1000.0 Hz Default: 5.0
M01P15	**REF OFFSET** When M01B16 is set at 1, the value entered into M01P15 is added to the selected reference parameter. It is used to trim the selected parameter.	R-W	Range: ±1000.0 Hz Default: 0
M01B16	**REF OFFSET SEL** Set at 1 to enable addition of the reference offset (M01P15).	R-W	Range: 0 or 1 Default: 0
M01P17	**PRECIS FREQ REF**	R-W	Range: ±1000.0 Hz Default: 0
M01P18	**PRECIS FREQ TRIM**	R-W	Range: 0 to 0.099 Hz Default: 0
M01P19 **M01P20**	**ANALOG REF 1** **ANALOG REF 2** See parameter M01B10	R-O	Range: M01P06 Hz Default: 0.0
M01B21 **M01B22** **M01B23** **M01B24**	**ANALOG REF2 SEL** **PRESET FREQ BIT0** **PRESET FREQ BIT1** **PRESET FREQ BIT2** Select the required reference.	R-W	Range: 0 or 1 Default: 0
M01P25 **M01P26** **M01P27** **M01P28** **M01P29** **M01P30** **M01P31**	**PRESET FREQ 1** **PRESET FREQ 2** **PRESET FREQ 3** **PRESET FREQ 4** **PRESET FREQ 5** **PRESET FREQ 6** **PRESET FREQ 7**	R-W	Range: ±1000.0 Hz Default: 0

M01P32	**PRESET FREQ 8** Note that parameter M02B07 (RAMPS SELECTION) must be set at 1 to have the corresponding accel/decel rates selected when the preset speeds are selected. Normal preset frequency references.  		
M01P33	**SKIP FREQUENCY 1** Enter a value to avoid a frequency which induces mechanical resonances.	R-W	Range: 0 to 1000.0 Hz Default: 0
M01P34	**SKIP FREQ 1 BAND** Enter a value to define the frequency range either side of Skip frequency 1 over which frequencies are avoided. The bandwidth is twice that entered into this parameter.	R-W	Range: 0 to 5.0 Hz Default: 0.5
M01P35	**SKIP FREQUENCY 2** Enter a value to avoid a frequency which induces mechanical resonances.	R-W	Range: 0 to 1000.0 Hz Default: 0
M01P36	**SKIP FREQ 2 BAND** Enter a value to define the frequency range either side of Skip frequency 2 over which frequencies are avoided. The bandwidth is twice that entered into this parameter.	R-W	Range: 0 to 5.0 Hz Default: 0.5
M01P37	**SKIP FREQUENCY 3** Enter a value to avoid a frequency which induces mechanical resonance's.	R-W	Range: 0 to 1000.0 Hz Default: 0
M01P38	**SKIP FREQ 3 BAND** Enter a value to define the frequency range either side of Skip frequency 3 over which frequencies are avoided. The bandwidth is twice that entered into this parameter.	R-W	Range: 0 to 5.0 Hz Default: 0.5
M01B39	**IN REJECT ZONE** Indicates the selected reference is within one of the skip frequency bands. The motor speed does not match the demand.	R-O	Range: 0 or 1 Default: 0
M01P40	**VEL FEEDFWD REF** This parameter indicates the velocity feed-forward reference when position control is used.	R-O	Range: ± M01P06 Default:
M01B41	**FEEDFWD SELECTED** This bit indicates that the position controller has selected the velocity feed-forward as a reference for the drive	R-O	Range: 0 or 1 Default:
M01B42	**PRESET SEL MODE** Set at 1 to allow the preset timer to sequentially select the preset frequencies. Set at 0 to allow bit parameters M01B22 through M01B24 to select the preset frequencies.	R-W	Range: 0 or 1 Default: 0

M01P43	**PRESET SCAN MODE** There are three modes for the auto preset scan timer: [0] FOREVER The drive will run the cycle continuously. [1] 1CYC&STOP The drive will run one cycle, then stop. Note that to stop at the end of the cycle, M06P07 (SEQUENCING MODE) must be "2OR3-WIRE" or "3-WIRE SP". [2] 1CYC&CONT The drive will run one cycle and continue at the last preset speed. The preset scan timer is reset and halted and PRESET 1 selected under the following conditions: • M01B42 (PRESET SEL MODE) is set at 0. • or M01B45 (PRESET SCAN RSET) is set at 1. • or M01P43 (PRESET SCAN MODE) is changed The preset scan timer is halted at a given stage in the cycle, maintaining the given preset under the following conditions: • The drive is in the FAULT state. • or M01B46 (PRESET SCAN HALT) is set at 1. If the preset scan timer is in both the reset and halted states, the reset state dominates. If none of the above conditions are true, the preset scan timer begins running and the presets are selected according to the mode selected. Note that the drive does not have to be in RUN mode for the preset scan timer to run. Also note that parameter M02B07 (RAMPS SELECTION) Must be set at 1 to have the corresponding accel/decel Rates selected when the preset speeds are selected as shown in the figures below.  	R-W	Range: [0] to [2] Default: [0] FOREVER





M01P44	**PRESET INDICATOR** Indicates which preset frequency is presently being used. [0] PRESET 1 000 [1] PRESET 2 001 [2] PRESET 3 010 [3] PRESET 4 011 [4] PRESET 5 100 [5] PRESET 6 101 [6] PRESET 7 110 [7] PRESET 8 111	R-O	Range: [0] to [7] Default:
M01B45	**PRESET SCAN RSET** Set at 1 to reset the preset timer and select PRESET FREQ 1 (M01P25). This bit parameter can be used to halt an existing preset sequence and start a new one. When this parameter is set at 0, the preset selection follows the preset timer according to the setting of parameter M01P43 (PRESET SCAN MODE).	R-W	Range: 0 or 1 Default: 0
M01B46	**PRESET SCAN HALT** Set at 1 to halt or suspend the preset timer at the present point in the cycle. This bit parameter can be used to halt an existing preset sequence and then resume when this parameter is then returned to 0. The drive runs at the halted preset speed until the M01B46 is returned to 0.	R-W	Range: 0 or 1 Default: 0
M01P47	**TIME IN PRESET 1** Enter a value to define the time the auto preset sequencer stays in "PRESET 1" (as shown by M01P44), when parameter M01B42 is set to 1.	R-W	Range: 0 to 3276.0 Sec Default: 20.0

M01P48	**TIME IN PRESET 2** Enter a value to define the time the auto preset sequencer stays in "PRESET 2" (as shown by M01P44), when parameter M01B42 is set to 1.	R-W	Range: 0 to 3276.0 Sec Default: 20.0
M01P49	**TIME IN PRESET 3** Enter a value to define the time the auto preset sequencer stays in "PRESET 3" (as shown by M01P44), when parameter M01B42 is set to 1.	R-W	Range: 0 to 3276.0 Sec Default: 20.0
M01P50	**TIME IN PRESET 4** Enter a value to define the time the auto preset sequencer stays in "PRESET 4" (as shown by M01P44), when parameter M01B42 is set to 1.	R-W	Range: 0 to 3276.0 Sec Default: 20.0
M01P51	**TIME IN PRESET 5** Enter a value to define the time the auto preset sequencer stays in "PRESET 5" (as shown by M01P44), when parameter M01B42 is set to 1.	R-W	Range: 0 to 3276.0 Sec Default: 20.0
M01P52	**TIME IN PRESET 6** Enter a value to define the time the auto preset sequencer stays in "PRESET 6" (as shown by M01P44), when parameter M01B42 is set to 1.	R-W	Range: 0 to 3276.0 Sec Default: 20.0
M01P53	**TIME IN PRESET 7** Enter a value to define the time the auto preset sequencer stays in "PRESET 7" (as shown by M01P44), when parameter M01B42 is set to 1.	R-W	Range: 0 to 3276.0 Sec Default: 20.0
M01P54	**TIME IN PRESET 8** Enter a value to define the time the auto preset sequencer stays in "PRESET 7" (as shown by M01P44), when parameter M01B42 is set to 1.	R-W	Range: 0 to 3276.0 Sec Default: 20.0
M02P01	**POST-RAMP REF** Frequency reference after the effects of ramps and normal currents limits.	R-O	Range: ±M01P06 Hz Default: 0.0
M02P02	**RAMP MODE** Select from: STD RAMP [0] Standard ramp FAST RAMP [1] Fast ramp The Ramp Modes parameter M02P02 controls deceleration ramps only. The settings are as follows: Setting Description 0 STD RAMP Standard ramp 1 FAST RAMP Fast ramp Mode 1 – Fast mode The ramp falls at the programmed deceleration rate subject only to the current limits programmed. This mode is normally used when an AC Regen or braking module is used.	R-W	Range: [0] STD RAMP [1] FAST RAMP Default: [0] STD RAMP
M02P03	**ACCEL RAMP 1** Acceleration ramp rate is expressed as the time for the	R-W	Range: 0.1 to 3276 s/100Hz Default: Size 0: 30.0 sec

	output frequency to increase by 100Hz. For example, a programmed ramp time of 5 seconds causes the frequency to increase or decrease by 50Hz in 2.5 seconds.		Size 1: 30.0 sec Size 2: 60.0 sec Size 3: 60.0 sec
M02P04	**DECEL RAMP 1** Deceleration ramp rate is expressed as the time for the output frequency to decrease by 100Hz.	R-W	Range: 0.1 to 3276 s/100Hz Default: Size 0: 30.0 sec Size 1: 30.0 sec Size 2: 60.0 sec Size 3: 60.0 sec
M02P05	**JOG ACCEL RAMP** Acceleration ramp rate is expressed as the time for the output frequency to increase by 100Hz.	R-W	Range: 0.1 to 3276 s/100Hz Default: 60.0 sec
M02P06	**JOG DECEL RAMP** Deceleration ramp rate is expressed as the time for the output frequency to decrease by 100Hz.	R-W	Range: 0.1 to 3276 s/100Hz Default: 60.0 sec
M02B07	**RAMPS SELECTION** When M02B07 is set at 1, M01P44 (PRESET INDICATOR) is used to select the associated ACCEL and DECEL ramps. For example, if M01P44 has a value of "PRESET 2" 010, ACCEL RAMP 2 (M02P11) and DECEL RAMP 2 (M02P21) will be selected. This allows the acceleration and deceleration ramps to change automatically with preset frequencies – whether the preset frequencies are selected by M01B22 through M01B24 or automatically by the preset timer. When M02B07 is set at 0, M02P08 to M02P10 & M02P18 to and M02P20 can be independently written to in order to select the acceleration and deceleration ramps.	R-W	Range: 0 or 1 Default: 0
M02B08 **M02B09** **M02B10**	**ACCEL SEL BIT 0** **ACCEL SEL BIT 1** **ACCEL SEL BIT 2** Binary coded selection of the required acceleration ramp to be used. (e.g. – to select M02P14 – Acceleration ramp 5, set M02B08 and M02B10 at 1.)	R-W	Range: 0 or 1 Default: 0
M02P11 **M02P12** **M02P13** **M02P14** **M02P15** **M02P16** **M02P17**	**ACCEL RAMP 2** **ACCEL RAMP 3** **ACCEL RAMP 4** **ACCEL RAMP 5** **ACCEL RAMP 6** **ACCEL RAMP 7** **ACCEL RAMP 8** Acceleration ramp rate is expressed as the time for the output frequency to increase by 100Hz.	R-W	Range: 0.1 to 3276 s/100Hz Default: 60.0 sec
M02B18 **M02B19** **M02B20**	**DECEL SEL BIT 0** **DECEL SEL BIT 1** **DECEL SEL BIT 2** Binary coded selection of the required acceleration ramp to be used. (e.g. – to select M02P24 – Deceleration ramp 5, set M02B18 and M02B20 at 1.)	R-W	Range: 0 or 1 Default: 0
M02P21 **M02P22** **M02P23**	**DECEL RAMP 2** **DECEL RAMP 3** **DECEL RAMP 4**	R-W	Range: 0.1 to 3276 s/100Hz Default: 60.0 sec

M02P24 **M02P25** **M02P26** **M02P27**	**DECEL RAMP 5** **DECEL RAMP 6** **DECEL RAMP 7** **DECEL RAMP 8** Deceleration ramp is expressed as the time for the output frequency to decrease by 100Hz.		
M02P32	**S-RAMP BAND** Enter a value to define the frequency band for the curve at each end of the S-ramp. Time taken for acceleration or deceleration on the curve is double that for a straight ramp. If the ramp time changes during a change of speed, the S-ramp does not give stepless acceleration or deceleration. For example: If different ramp rates are used for acceleration and deceleration, and the drive passes through zero speed. If the ramp rates are changed using the acceleration or deceleration select bits.	R-W	Range: 0 to M01P06 Hz Default: 0
M02P33	**ACEL RECOVR RAMP** Use this parameter when using the drive in applications where the load is cyclic in nature (punch Press, vibratory feeder, injection molding machine, kiln and other applications with repeated shock loading where the requirement to minimize speed droop is important). For a typical application as described above, set the following parameters as follow: M02P33 (ACEL RECOVR RAMP) = 1 sec to .1 sec M00P06 (ACCEL RAMP1) = 1 sec to 5 sec M05P11 (AUTO BOOST VOLT) = 3% to 6% for size 0 2% to 4% for size 1 2% to 3% for size 2 1% to 2% for size 3 M05P14 (FIXED BOOST VOLT) = 2.0% for size 0 1.5% for size 1 1.0% for size 2 0.5% for size 3 Change M05P14 only if starting the load is a problem; otherwise leave this parameter at the default setting.	R-W	Range: 0.01 to 100.00 sec Default: 5.0 sec
M02B35	**DISABLE RAMPS** Ramps can only be disabled in closed loop mode.	R-W	Range: 0 or 1 Default: 0
M02B36	**RAMP HOLD** Set at 1 to hold the speed reference ramp. If the drive has been commanded to stop, the ramp hold function is disabled.	R-W	Range: 0 or 1 Default: 0
M03P01	**PG CONSTANT PPR** Use this parameter to set the pulse per revolution (ppr) of the encoder (pulse generator).	R-W	Range: 0 to 8192 ppr Default: 1024
M03P02	**PG NO OF PHASES** Select [0] if only A phase or B phase is used. Select [1] if A & B phases are used. [0] ONE PHASE One phase A or B from PG [1] TWO PHASE Two phases A & B from PG	R-W	Range: [0]-[1] Default: [1] TWO PHASE

M03P03	**PG ROTATION SEL** [0] CLOCKWISE Clockwise rotation [1] C-CLOCKWS Counterclockwise rotation This setting determines how the drive interprets the rotation of the motor. This parameter can be used to change the direction of the motor without having to change the encoder (pulse generator) wiring.	R-W	Range: [0]-[1] Default: [0] CLOCKWISE
M03P04	**PG SPEED** This parameter Indicates encoder speed.	R-O	Range: ± 32760 RPM Default
M03P05	**MOTOR GEAR TEETH** Parameter M03P05 & M03P06 are to set the gear ratio between the motor and the load when the encoder (pulse generator) is connected to load side. Motor speed (RPM) = $\text{EncoderSpeed} \times \frac{\text{LoadGearTeeth}}{\text{MotorGearTeeth}}$	R-W	Range: 1 to 1000 Default: 1
M03P06	**LOAD GEAR TEETH** See parameter M03P05.	R-W	Range: 1 to 1000 Default: 1
M03P07	**PG LOSS MODE** Closed Loop Parameter Set to determine the stopping method or Alarm only when an encoder loss (PG LOSS) is detected. A PG LOSS is detected when the signal is interrupted and no pulses are received or the encoder frequency is different from output frequency by a M03P29 value. PG LOSS detection time can be adjusted using parameter M03P08. When zero speed is commanded PG LOSS is disabled. [0] COASTSTOP Coast stop when PG Loss [1] RAMP STOP Ramp stop when PG Loss [2] ALARMONLY Alarm only when PG Loss [0] Coast Stop: PG Loss will cause the motor to coast stop and set a "PG LOSS" fault. In this mode M10B01 "Drive Normal" parameter is set to 0 indicating drive tripped. [1] Ramp Stop: PG Loss will cause the motor to ramp stop and set a "PG LOSS" fault. In this mode M10B01 "Drive Normal" parameter is set to 0 indicating drive tripped at the end of ramp stop. [2] Alarm Only: PG Loss will cause the drive to continue running in Open Loop mode and displays a "ALARM MESSAGE PG LOSS" message. In this mode M10B01 (Drive Normal) is kept set to 1 indicating Drive Normal (not tripped). In all modes when PG Loss is detected M10B12 PG Loss status bit is set to 1. M10B12 is cleared when the drive is stopped and a reset is initiated via Stop/Reset keypad Key or digital input Reset via terminal block.	R-W	Range: [0]-[2] Default: [0] COSTSTOP
M03P08	**PG LOSS DELAY** Closed Loop Parameter Encoder (pulse generator) loss delay as described above in parameter M03P07.	R-W	Range: 0 to 10.0 sec Default: 1.0

M03P09	**SPEED REF TRIM** Closed loop parameter Use this parameter as speed reference trim.	R-W	Range: ±M01P06 Hz Default: 0.0
M03B10	**SPEED TRIM SELEC** Closed loop parameter Set at 1 to select addition of the speed reference trim M03P09.	R-W	Range: 0 or 1 Default: 0
M03P11	**FINAL SPD DEMAND** Closed loop parameter Final speed demand to speed loop circuit.	R-O	Range: max range in % Default:
M03P12	**SPEED FEEDBACK** Closed loop parameter Speed feedback from the encoder or some other device via parameter M03P13	R-O	Range: max range in % Default:
M03P13	**OTHER FEEDBACK** Closed loop parameter [0] ANALOGIN1 Analog Input #1 [1] ANALOGIN2 Analog Input #2 When either "ANALOGIN1" or "ANALOGIN2" is selected, and M03B14 (FEEDBACK SELECT) is also set to 1, M07P11 (ANALOG IN 1 SCAL) or M07P14 (ANALOG IN 2 SCAL) respectively will scale the analog speed feedback (+/- 12.500 volts maximum) which will be displayed by parameter M03P04 (PGSPEED) when the drive is in either open or closed loop mode as set by parameter M11P38 (DRIVE TYPE). Additionally when analog speed feedback is selected, (M03B14 = 1), parameters M03P03 (PG ROTATION SEL) and M03P34 (ANALOG FDBK BIAS) can be used to change the feedback polarity or add a bias to the feedback respectively. The scaling is such that: when M07P11 (ANALOG IN 1 SCAL) or M07P14 (ANALOG IN 2 SCAL) are set to the default value of 1.000, a +/- 12.500 volt signal will produce a value for M03P04 (PG SPEED) equal to the "Absolute Maximum RPM". "Absolute Maximum RPM" is 1.125 times the RPM determined by M01P06 (MAX FREQUENCY) and M05P10 (NUMBER OF POLES).	R-W	Range: [0]-[1] Default: [0] ANALOGIN1
M03B14	**FEEDBACK SELECT** Closed loop parameter Set at 1 to select the analog speed feedback signal defined by M03P13. The default value of 0 for this parameter selects encoder feedback.	R-W	Range: 0 or 1 Default: 0
M03P15	**SPEED ERROR** Closed loop parameter Speed error is the difference between the final speed demand and the speed feedback reference after modification by the speed regulator.	R-O	Range: max range in % Default:
M03P16	**SPEEDLOOP OUTPUT** Closed loop parameter Speed loop output is the output of the speed regulator, which forms a torque demand. Speed loop output = P x e + I x e e = Final Speed Demand – Speed Feedback x D Where: P: proportional gain M03P17 I: integral gain M03P18 D: differential gain M03P19 e: speed error M03P15	R-O	Range: max range % Default:

M03P17	**SPEEDLOOP P GAIN** Closed loop parameter Speed loop regulator proportional gain See Parameter M03P16.	R-W	Range: 0 to 10000 Default: 150
M03P18	**SPEEDLOOP I GAIN** Closed loop parameter Speed loop regulator integral gain See Parameter M03P16.	R-W	Range: 0 to 10000 Default: 375
M03P19	**SPEEDLOOP D GAIN** Closed Loop Parameter Speed loop regulator differential gain. See parameter M03P16.	R-W	Range: 0 to 1000.0% Default: 0
M03P20	**ZERO SPEED THSLD** Closed & open loop parameter Open Loop: If the absolute value of the motor speed (M05P01) falls below the level defined by this parameter, the AT ZERO SPEED M10B03 is set to 1. Closed Loop: If the absolute value of the speed feedback (M03P12) falls below the level defined by this parameter, the AT ZERO SPEED M10B03 is set to 1.	R-W	Range: 0 to 20.0 Hz Default: 1.0
M03P21	**AT SPEED LOW LIM** Closed & open loop parameter This parameter defines the lower threshold for the AT SPEED parameter M10B05. See parameter M03P27 for more details.	R-W	Range: 0 to 1000.0 HZ Default: 1.0
M03P22	**AT SPEED UP LIM** Closed & open loop parameter This parameter defines the upper threshold for the AT SPEED parameter M10B05. See parameter M03P27 for more details.	R-W	Range: 0 to 1000.0 HZ Default: 1.0
M03P23	**OVERSPEED THRSLD** Closed & open loop parameter This parameter defines the speed at which the drive will trip due over-speed.	R-W	Range: 0 to 1000.0 HZ Default: 1000.0
M03P24	**SPEED FBK FILTER** Closed loop parameter This parameter is used to filter the speed feedback.	R-W	Range: 5 to 200 msec Default: 25
M03P25	**PG SMOOTHING** A sliding window filter is provided to smoothen the encoder speed feedback. The length of the sliding window is specified by this parameter. This number represents the sliding window time in milliseconds. This is useful to ensure a more accurate pulse count to increase speed feedback smoothness. If the encoder speed is not filtered, the torque current demand can include a high level of ripple.	R-W	Range: 1 to 10 Default: 3
M03P26	**SPEED DROOP** Closed loop parameter This parameter is used to set the percentage of speed droop as a function of torque load. The value entered represents the percent of base speed droop in speed at full torque load. This function can be used to balance the loads of two or more motors or to use a motor as a helper to a main motor.	R-W	Range: 0 to 100.0 % Default: 0.0
M03B27	**ABSOLUTE @ SPEED** M03P27 = 0 reference window detection: Open Loop: The At Speed parameter (M10P05) is set to 1 when the motor frequency (M05P01) is within the At Speed band defined by (reference - lower limit) to (reference + upper limit):	R-W	Range: 0 or 1 Default: 0

	|M05P01| ≥ (|M01P03| - M03P21) AND |M05P01| ≤ (|M01P03| + M03P22) Closed Loop: The At Speed parameter (M10P05) is set to 1 when the speed feedback (M03P12) is within the At Speed band defined by (reference - lower limit) to (reference + upper limit): |M03P12| ≥ (|M01P03| - M03P21) AND |M03P12| ≤ (|M01P03| + M03P22) <u>M03P27 = 1 absolute window detection:</u> Open Loop: The At Speed parameter (M10P05) is set to 1 when the motor frequency (M05P01) is within the At Speed band defined by the lower limit and the upper limit: |M05P01| ≥ M03P21 AND |M05P01| ≤ M03P22 Closed Loop: The At Speed parameter (M10P05) is set to 1 when the speed feedback (M03P12) is within the At Speed band defined by the lower limit and the upper limit: |M03P12| ≥ M03P21 AND |M03P12| ≤ M03P22		
M03P28	**SPEEDDROOP DELAY** Closed Loop Parameter Use this parameter to change the responsiveness of the Speed Droop Controller. Selection: [0] 0 MSEC [1] 5 MSEC [2] 43 MSEC [3] 85 MSEC [4] 171 MSEC [5] 341 MSEC [6] 683 MSEC [7] 1370 MSEC	R-W	Range: 0 MSEC to 1370 MSEC Default: 43 MSEC
M03P29	**PGLOSS DEVIATION** Closed Loop Parameter Use this parameter to set the PG LOSS detection level for speed deviation between the encoder and the output frequency. See M03P07 for more information.	R-W	Range: 0 to 50 % Default: 10
M03P30	**PG REVOLUTIONS** This parameter indicates the position in terms of revolutions of the drive encoder.	R-O	Range: ±32767 Revolutions Default:
M03P31	**PG POSITION** This parameter indicates the position in terms of fractions of a revolution of the drive encoder, where 32768 =1 revolution.	R-O	Range: ±32767 (±1 turn) Default:
M03B32	**PG MARKER RST EN** The drive encoder (pulse generator) marker channel can be used to reset the drive encoder position (M03P31) and revolutions (M03P30) (if M03P32 = 1), but only if M03B33 is initially = 0.	R-W	Range: 0 or 1 Default: 0
M03B33	**PG MARKER FLAG** The drive encoder (pulse generator) marker channel can be used to reset the encoder position M03P31 and revolutions M03P30 if M03B32 =1, and set the marker flag M03B33. The marker flag is set when the marker input becomes active, but it is not reset by the drive. The user must reset this flag.	R-W	Range: 0 or 1 Default: 0

M03P34	**ANALOG FDBK BIAS** Closed loop parameter A plus or minus bias or offset in percent of "absolute Maximum RPM". "Absolute Maximum RPM" is 1.125 times the RPM determined by M01P06 (MAX FREQUENCY) and M05P10 (NUMBER OF POLES). This bias or offset is added to the scaled analog speed feedback when parameter M03B14 (FEEDBACK SELECT) is set to 1. See parameter M03P13 description for more details.	R-W	Range: ±10.000% Default: 0.000
M04P01	**MOT CURR-TOTAL** Indicates the magnitude of the total motor current.	R-O	Range: 0 to ±M11P35 A Default:
M04P02	**MOT CURR-TORQ** Indicates the magnitude of the torque-producing motor current.	R-O	Range: 0 to ±M11P35 A Default:
M04P03	**MOT CURR-MAGNETZ** Indicates the magnitude of the magnetizing motor current.	R-O	Range: 0 to ±M11P35 A Default:
M04P04	**MOTOR CURR LIMIT** Normal current limit See parameter M05P06.	R-W	Range: 0 to $\frac{M11P35}{M05P06} \times 100\%$ Default: Max Number
M04P05	**REGEN CURR LIMIT** Normal current limit. See parameter M05P06.	R-W	Range: 0 to $\frac{M11P35}{M05P06} \times 100\%$ Default: Max Number
M04P06	**TORQUE DEMAND** The torque demand can be derived either from the speed loop output or programmed separately depending on the value of M04P07. The units of the torque demand are % of rated torque, where 100% rated torque is defined by the user. 100% rated torque is defined by the settings of the drive parameters as shown in the following example: Rated Motor Current M05P08 = 180A Torque I Factor M05P13 = 0.95 Assuming frequency is at or below rated motor frequency. At 100% torque, Rated torque current = 180 x 0.95 = 171A A positive value of torque demand indicates motoring torque in the positive direction, or regenerating torque in the reverse direction. A negative value indicates regenerative torque in the positive direction and motoring torque in the reverse direction.	R-O	Range: 0 to $\frac{M11P35}{M05P06} \times 100\%$ Default:
M04P07	**TORQ MODE SELECT** <u>Open Loop</u> [0] SPEED CTR Speed control mode [1] TORQ CONT Torque control [2] TORQ SPD Torque limited speed control <u>Closed Loop</u> [0] SPEED CTR Speed control mode [1] TORQ CONT Torque control [2] TORQ SPD Torque limited speed control [3] WINDER Wind-unwind torque control [4] TRQ FDFWD Speed control with torque feed-forward	R-W	Range: [0] to [4] Default: [0] SPEED CTR

	[0] SPEED CTR Speed control mode The torque demand is equal to the speed loop output M03P16. [1] TORQ CONT Torque control The torque demand is given by the sum of the torque reference and the torque offset, if enabled. The speed is not limited, however, the drive will trip if the speed exceeds the OVERSPEED threshold M03P23. [2] TORQ SPD Torque limited speed control The SPEED LOOP OUTPUT M03P16 defines the torque demand, but is limited by the torque demand (M04P12 + M04P13). The speed controller will try and accelerate the machine to the final speed demand M03P11 level with a torque demand defined by M04P12 + M04P13. This mode of operation can be used when torque control is required, but maximum speed must be limited. [3] WINDER Wind-Unwind Torque Control WHEN FINAL SPEED DEMAND M03P11 IS Positive: - A positive torque demand (M04P12 + M04P13) will provide torque control with a positive speed limit defined by the FINAL SPEED DEMAND M03P11. A negative torque demand (M04P12 + M04P13) will provide torque control with a negative speed limit defined by the Zero Speed Threshold M03P20. When FINAL SPEED DEMAND M03P11 IS NEGATIVE: - A negative torque demand will provide torque control with a negative speed limit defined by the FINAL SPEED DEMAND M03P11. A positive torque demand will provide torque control with a positive speed limit defined by the Zero Speed Threshold M03P20. [4] TRQ FDFWD Speed control with torque feed-forward The drive operates under speed control, with a torque reference (M04P12 + M04P13) value added to the speed controller output M03P16. This can be useful to improve the regulation of some systems where the speed loop gains need to be low.		
M04P10	**TORQUE OUTPUT** Indicates torque in the motor as % of rated torque. Below rated frequency, the torque output is equal to the torque-producing current relative to $i_{torq\ rated}$. Above rated frequency, the torque is compensated to allow for the reducing flux in the motor.	R-O	Range: 0 to $\frac{M11P35}{M05P06} \times 100\%$ Default:
M04P11	**SYM CURRENT LIM** After having set the required value of maximum current in M05P06, you may increase or decrease the percentage overload current using M04P11. The maximum percentage that can be set is limited by the overload current rating of the drive. The limit applies when motoring and regenerating. The value of M04P11 is automatically reduced when the value of M05P06 is increased beyond the default value.	R-W	Range: See M04P04 % Default: 120 or 150 min

M04P12	**TORQUE REFERENCE** Closed loop parameter Torque reference in %	R-W	Range: 0 to $\frac{M11P35}{M05P06} \times 100\%$ Default: 0
M04P13	**TORQUE OFFSET** Closed loop parameter Parameter for an offset to be added to the main torque reference.	R-W	Range: 0 to $\frac{M11P35}{M05P06} \times 100\%$ Default: 0
M04B14	**TORQ OFFSET SEL** Closed loop parameter If set to 1 the torque offset is added to the torque reference.	R-W	Range: 0 or 1 Default: 0
M04P15	**TORQ CURR DEMAND** Closed loop parameter The current demand is derived from the torque demand. Provided the motor is not in the field weakened the torque and current demands are the same. In the field weakening range the current demand is increased with reduced flux. The level of flux is derived from the motor model within the drive controller. M04P15 = M04P06 x flux / rated flux	R-O	Range: 0 to $\frac{M11P35}{M05P06} \times 100\%$ Default:
M04P17	**FLUX DEMAND** Closed loop parameter Flux demand is constant below motor base speeds. In the field weakening region the flux demand is reduced and torque current demand is increased. The level of flux is derived from the motor model within the drive controller.	R-O	Range: 0 to 100.0 % Default:
M04P18	**FLUX CURR DEMAND** Closed loop parameter The current demand is derived from the flux demand.	R-O	Range: 0 to $\frac{M11P35}{M05P06} \bullet 100\%$ Default:
M04P23	**ROTOR TIME CONST** Closed loop parameter Motor rotor time constant.	R-W	Range: 0 to 10000 msec Default: Model dependent
M04P32	**INITIAL FLUX FRQ** Closed Loop Parameter This parameter is used to select initial fluxing frequency at rated flux current at the start. Initial fluxing of the motor is used to enhance acceleration performance. It results shorter overall acceleration and improved torque response at the start.	R-W	Range: 0.0 10.0 Hz Default: 0
M04B33	**INITIAL FLUXING** Closed loop parameter Use this parameter to enable or disable the initial fluxing function.	R-W	Range: 0 or 1 Default: 1
M04B36	**EXTRNAL FLUX SEL** Closed loop parameter If set to 1, the drive uses an external flux reference as set by parameter M04P37 (EXTRNAL FLUX REF) instead of the default internal rated flux reference. In either case, if the motor voltage exceeds the field weakening voltage (typically 95% of rated motor voltage) the flux will be reduced to keep the motor voltage from exceeding this level.	R-W	Range: 0 or 1 Default: 0
M04P37	**EXTRNAL FLUX REF** Closed loop parameter External flux reference in percent of rated flux. Analog inputs or the outputs of variable selector function blocks can be routed to this parameter.	R-W	Range: 0 to 100.0% Default: 0.0
M04B44	**EN ASYM TORQ LMT** Closed loop parameter If set to 1, the drive uses parameters M04P45 and	R-W	Range: 0 or 1 Default: 0

	M04P46 below respectively for the positive and negative torque limits when parameter M04P07 (TORQ MODE SELECT) is set to 'TORQ SPD" in Closed-Loop Mode. If set to 0, the drive uses the absolute value of M04P12 (TORQUE REFERENCE) to create symmetrical positive and negative torque limits when parameter MO4P07 (TORQ MODE SELECT) is set to "TORQ SPD" in Closed-Loop Mode.		
M04P45	**POS TORQUE LIMIT** Closed loop parameter Positive Torque Limit in %. See parameter M04B44 (EN ASYM TORQ LMT) for full details.	R-W	Range: 0 to $+\frac{M11P35}{M05P06}\times 100\%$ Default: 0
M04P46	**NEG TORQUE LIMIT** Closed loop parameter Negative Torque Limit in %. See parameter M04B44 EN ASYM TORQ LMT) for full details.	R-W	Range: 0 to $+\frac{M11P35}{M05P06}\times 100\%$ Default: 0
M05P01	**POST-SLIP FREQ** Final frequency applied to the motor after the effects of current limits and slip compensation. Note: For scaling purposes use +/- 1.125 x M01P06 Hz for the maximum value of this parameter.	R-O	Range: ±M01P06 Hz Default:
M05P02	**MOTOR SHAFT RPM** Indicates motor shaft RPM. The number of poles must be entered correctly in M00P04 (M05P10).	R-O	Range: ± 32760 RPM Default:
M05P03	**MOTOR VOLTAGE** Indicates the RMS voltage applied to the motor.	R-O	Range: 0 to M05P08 V_{RMS} Default:
M05P04	**DC BUS VOLTAGE** Indicates the DC bus voltage.	R-O	Range: 0 to 1000.0 V Default:
M05P05	**MOTOR POWER** Indicates the real component of the power output.	R-O	Range:0 to $\pm$ M05P03 $\times$ M11P35 $\times \frac{\sqrt{3}}{1000}$ KW Default:
M05P06	**RATED MOTOR CURR** When parameter M05P06 is set at a value lower than the default rating of the drive, the maximum current of the drive can be greater than 1.5 times the motor rating. Consequently, the maximum value of current limit and torque parameters (M04P04, M04P05, M04P06, M04P11 and M06P04) can be increased proportionately. For example, if a 180 Amp drive has parameter M05P06 set at 90 Amps, the maximum values of parameters M04P04, M04P05, M04P11 and M06P04 can be 300% (2 x 150%). This allows larger drives to be used for a high starting torque. When the value is increased beyond the default value of M05P06, the values of M04P04, M04P05 and M04P11 are automatically decreased. The value entered affects the following: Slip compensation Dynamic V/f	R-W	Range: 0-1800 A Default: Model Dependent

	lxt detection level Industrial and HVAC applications Industrial applications benefit from a higher percentage of overload current, but have a lower nominal current. HVAC applications benefit from a higher nominal current, but have a lower percentage of overload current (120%). The overload current has the same value in each case. See parameter M05P18.		
M05P07	**RATED MOTOR RPM** The rated full load rpm is used with the motor rated frequency to calculate the rated slip of induction motors in Hz. $\text{RatedSlip} = \text{M05P09} - \frac{\text{M05P10} \times \text{M05P07}}{120}$ M05P07 is Rated Motor RPM M05P09 is Base Motor Frequency M05P10 is Number of Poles <u>Open loop:</u> If SLIP COMP ENABLE (M05B38) is set to 0 slip compensation is disabled. If slip compensation is required, M05P07 should be set to the nameplate value and M05B38 should be set at 1. Slip compensation is normally used to prevent droop in the motor shaft speed as load is applied. <u>Closed Loop:</u> Motor full load rpm is used with motor rated frequency to determine the full load slip of the motor necessary for closed loop vector control.	R-W	Range: 0 to 32760 RPM Default: Model Dependent
M05P08	**RATED MOTOR VOLT** Enter the value from the motor rating plate in order to define the maximum output voltage of the drive.	R-W	Range: 100 to 600 VRMS Default: 240 480 575
M05P09	**BASE MOTOR FREQ** Enter a value of frequency at which the rated voltage is to be applied to the motor. The motor then enters the constant-power or field-weakening region.	R-W	Range: 10.0 to 600 Hz Default: 60.0
M05P10	**NUMBER OF POLES** Enter the value from the motor rating plate for correct slip compensation and RPM indication.	R-W	Range: [0] (2 POLES) to [15] (32 POLES) Default: [1] (4 POLES)
M05P11	**AUTO BOOST VOLT** The level of boost is determined by: Autoboost = Voltage boost x itorq/Itorq rated Use this parameter when using the drive in applications where the load is hard to start. Set the following parameters as follow: M05P11 (AUTO BOOST VOLT) = 3% to 6% for size 0 2% to 4% for size 1 2% to 3% for size 2 1% to 2% for size 3 M05P14 (FIXED BOOST VOLT) = 2.0% for size 0 1.5% for size 1 1.0% for size 2 0.5% for size 3	R-W	Range: 0 to 25.5% of M05P08 Default: Size 0: 1% Size 1: 1% Size 2: 0.5% Size 3: 0.3%

	Do not increase M05P11 & M05P14 above the recommended values before checking with the factory.		
M05P12	**VOLT CONTR MODE** [0] AUTO Auto boost only [1] FIXED Fixed boost only [2] AUTO+ FIXD Auto boost & fixed boost only	R-W	Range: [0] to [2] Default: [2] AUTO + FIXD
M05P13	**TORQUE I FACTOR** Torque current which produces rated torque in the motor in percent of RATED MOTOR CURRENT M05P06.	R-W	Range: 0 to 100.0% Default: Model dependent
M05P14	**FIXED BOOST VOLT** Sets voltage boost at 0Hz as a percentage of the rated motor voltage. Use this parameter when using the drive in applications where the load is hard to start. Set the following parameters as follow: M05P11 (AUTO BOOST VOLT) = 3% to 6% for size 0 2% to 4% for size 1 2% to 3% for size 2 1% to 2% for size 3 M05P14 (FIXED BOOST VOLT) = 2.0% for size 0 1.5% for size 1 1.0% for size 2 0.5% for size 3 Do not increase M05P11 & M05P14 above the recommended values before checking with the factory.	R-W	Range: 0 to 25.5% of M05P08 Default: Size 0: 1.0% Size 1: 0.8% Size 2: 0.4% Size 3: 0.2%
M05P15	**FLUX CURR FACTOR** Closed loop parameter Magnetizing current which produces rated flux in the motor in percent of RATED MOTOR CURRENT M05P06.	R-W	Range: 0 to 100.0% Default: Model dependent
M05P16	**MOTOR TORQUE VOLT** Torque voltage command to motor.	R-O	Range: 0 to M05P08 Vrms Default:
M05P17	**MOTOR FLUX VOLT** Flux voltage command to motor.	R-O	Range: 0 to M08P08 Vrms Default:
M05P18	**OVERLOAD TIME** Enter a value for the required duration of maximum overload current M11P35. See parameter M10B07 (IxT ALARM) for details on how the setting of this parameter affects the speed sensitive motor overload feature.	R-W	Range: 0 to 60 S Default: 60
M05P20	**MAX PWM CARRIER** Sets maximum PWM carrier frequency in Hz	R-W	Range: 1000 to 3000 Default: Size 0: 2000 Hz Size 1: 2000 Hz Size 2: 1800 Hz Size 3: 1200 Hz
M05P21	**MIN PWM CARRIER** Sets minimum PWM carrier frequency in Hz	R-W	Range: 10 to M05P20 Default: 1000
M05P22	**SPEED @ MAX CARRIER** Set drive speed to correspond to maximum PWM carrier frequency M05P20	R-W	Range: 10 to M01P06 Default: 60 Hz
M05P23	**SPEED @ MIN CARRIER** Set drive speed to correspond to minimum PWM carrier frequency M05P21	R-W	Range: 0 to (M05P22-1) Default: 10 Hz
M05P24	**PWM CARRIER FREQ** This parameter shows PWM carrier frequency	R-O	Range: M05P21 to M05P22 Hz Default:

M05P33	**RATED LINE VOLTS** Enter a value of voltage at which the rated voltage is to be applied to the input of the drive.	R-W	Range: 200-250V for D2 Models 380-500V for D4 Models 500-600V for D5 Models Default: 240V for D2 Models 480V for D4 Models 575V for D5 Models
M05P34	**AC LINE VOLTAGE** Indicates RMS voltage of the AC supply.	R-O	Range: 0 to 1000.0 VRMS Default:
M05P35	**SLIP FREQUENCY** Closed loop parameter This parameter displays motor slip frequency.	R-O	Range: 0 to 30.00 Hz Default:
M05B38	**SLIP COMP ENABLE** Open loop only parameter Set M06B38 to 1 to enable slip compensation.	R-W	Range: 0 or 1 Default: 0
M05P47	**AC LINE RIPPLE** Indicates the peak to peak ripple on the rectified AC line input voltage. The input AC line voltage is continuously monitored for excessive AC line voltage unbalance or for phase loss. An INPUTLOSS fault is generated when excessive AC line voltage unbalance or phase loss is detected.	R-O	Range: 0.0 to 1000.0 V Default:
M05P48	**DC BUS RIPPLE** Indicates the peak to peak ripple on the DC bus voltage. The DC bus voltage is continuously monitored for excessive ripple when the drive is running. A BUSRIPPLE FAULT is generated when the ripple becomes excessive in order to protect the drive. The BUSRIPPLE fault can be caused due to excessive AC line voltage unbalance, phase loss or defective DC bus capacitors.	R-O	Range: 0.0 to 1000.0 V Default:
M05P50	**BUS CAPACITANCE** Represents the DC bus capacitance of the drive measured at power-down. This value is model dependent is used mainly for troubleshooting.	R-O	Range: 0.0 to 32767 μsec/V^2 Default:
M05P54	**IxT BREAK FREQ** Used to program the speed sensitive IxT curve. When operating a general purpose (TEFC) motor at reduced speeds, the ability to dissipate heat is also reduced due to slower cooling fan speed. This parameter sets the motor frequency break point below which motor derating is required. See parameter M10B07 (IxT ALARM) for details on the speed sensitive overload feature.	R-W	Range: 1.0 to M05P09 Hz Default: 60.0
M05P55	**IxT ZER FRQ THLD** Used to program the speed sensitive IxT curve. When operating a general purpose (TEFC) motor at reduced speeds, the ability to dissipate heat is also reduced due to slower cooling fan speed. This parameter determines the motor derating at low speeds. Specifically, this parameter sets the maximum continuous motor current at zero speed. A value of 60.0 is suggested for these type motors. For blower-cooled (TENV) motors, a value of 100.0 is suggested. See parameter M10B07 (IxT ALARM) for details on the speed sensitive overload feature.	R-W	Range: 1.0 to 100.0 % Default: 100.0
M06P01	**STOP MODE** Parameter M06P01 controls the stopping mode in the speed control mode. In Torque Mode, regardless of M06P01 value, the stopping	R-W	Range: [0] to [4] Open Loop [0] to [2] Closed Loop Default: [0] RAMP

	method is always coast to stop. **Open Loop** [0] RAMP The drive ramps to zero speed [1] COAST Coast to stop [2] RAMP+DC Ramp + DC injection braking [3] DC INJECT Automatic DC injection braking [4] TIMED DC Timed DC injection braking **Closed Loop** [0] RAMP The drive ramps to zero speed [1] COAST Coast to stop [2] RAMP+DC Ramp + Hold at Zero speed The settings are described below: [0] Ramp stop: Open or Closed Loop The drive ramps to zero speed during the first phase; in the second phase the output is disabled. [1] Coast to Stop: Open or Closed Loop The inverter output is disabled as soon as a STOP command is received, and the motor coasts to rest. The inverter cannot be re-enabled for a time delay "de-flux time". The de-flux time allows the rotor flux to decay in induction motors. The de-flux time is model dependent. [2] Ramp plus DC injection braking: Open Loop The drive ramps to zero speed during the first phase; in thesecond phase injection braking is used at a current level programmed in parameter M06P04 for a time specified by M06P05. [2] Ramp + Hold at zero speed: Closed Loop The drive ramps to zero speed during the first phase; in the second phase the drive holds zero speed for a time specified by M06P05. [3] Automatic DC injection braking Open Loop only In the first phase after a stop command the inverter output is disabled for a time to de-flux the rotor. In the second phase injection braking is used at a current level programmed in parameter M06P04 for a time automatically determined by the drive when zero speed is detected. The drive automatically senses zero speed and therefore it adjusts the injection time to suit the application. If the injection current level specified in M06P04 is too small the drive will not sense zero speed (normally a minimum of 50 - 60% is required for M06P04) [4] Timed DC injection braking Open loop only In the first phase after a stop command the inverter output is disabled for a time to de-flux the rotor. In the second phase injection braking is used at a current level programmed in parameter M06P04 for a time specified by M06P05.		
M06P02	**AUTO-START MODE** There are three modes:	R-W	Range: [0] to [2] Default: [0] DISABLED

	[0] DISABLED The drive will not automatically start when AC power is applied. [1] ALWAYS The drive always starts when AC power is applied. [2] RUNNING The drive starts only if it had been running when AC power was previously removed. The Auto-start modes are as follows: The Auto-start modes define the behavior of the drive when AC power is applied. Mode[0] – DISABLED The drive will not automatically start when AC power is applied. Mode [1] – ALWAYS The drive always starts irrespective of the state before AC power was removed. The STOP input switch must be closed. Mode [2] – RUNNING (Power-down dependent) The drive starts only if it had been running when AC power was removed. The STOP input switch must be closed.		
M06P03	**AC SUPPLY MODE** This parameter is used to tell the drive if the AC line voltage source is from a three phase supply or a single phase supply. Note: set this parameter to 1-PHASE only if the drive is factory engineered for single phase operation or the drive is derated. The derating factor is usually 50%, but this is not always true. Contact the factory if single phase operation is required. [0] 1-PHASE Single phase operation [1] 3-PHASE Three phase operation	R-W	Range: 1-PHASE or 3-PHASE Default: 3-PHASE
M06P04	**DC INJECT LEVEL** DC Current level at injection.	R-W	Range: 0 to $\frac{\text{M11P35}}{\text{M05P06}} \times 100$ % of FLC Default: 100
M06P05	**DC INJECT TIME** When M06P01 is set at [2] or [4], enter the required injection time.	R-W	Range: 0.5 to 25.5 Default: 5.0
M06B06	**DB CHOPPER MODE** Use this parameter to enable or disable the Brake Chopper Function when the drive is not running. - When M06P06 is set at 0 Brake Chopper function is enabled even when the drive is not running. - When M06P06 is set at 1 Brake Chopper function is disabled when the drive is not running.	R-W	Range: 0 or 1 Default: 0
M06P07	**SEQUENCING MODE** [0] 2OR3-WIRE: 2 or 3-wire logic [1] 3-WIRE SP: 3-wire Run Fwd / Run Rev [2] RFWD RREV: Run Fwd / Run Rev logic [3] 2-WIRE: 2-wire logic	R-W	Range: [0] to [3] Default: [0] 2OR3-WIRE

M06B08 SEQUENCING BIT 0
M06B09 SEQUENCING BIT 1
M06B10 SEQUENCING BIT 2
M06B11 SEQUENCING BIT 3

R-W

Range: 0 or 1
Default: 0

Binary coded selection of sequencer mode.

There are four sequencing modes as shown below. Any terminal can be used for any of the function in each mode.

[0] [2OR3-WIRE] 2 or 3-wire logic
[1] [3-WIRE-SP] 3-wire Run Fwd / Run Rev
[2] [RFWD RREV] Run Fwd / Run Rev logic
[3] [2-WIRE] 2-wire logic

[0] 2OR3-WIRE: 2 or 3-wire logic

		TB2 default pin number
Sequencing bit 0	Run (latching)	2
Sequencing bit 1	Jog	3
Sequencing bit 2	Reverse	4
Sequencing bit 3	Not used	

When Keypad mode is enabled, sequencing bit 0 can be over-ridden by the RUN key and sequencing bit 2 can be over-ridden by the FWD-REV key.

[1] 3-WIRE-SP: 3-wire Run Fwd / Run Rev

		TB2 default pin number
Sequencing bit 0	Run forward (latching)	2
Sequencing bit 1	Jog forward	3
Sequencing bit 2	Run Reverse (latching)	4
Sequencing bit 3	Jog Reverse	

When Keypad mode is enabled, the RUN key can also start the drive, and the FWD-REV key can change the direction (unless one of the sequencing bit signals is being held, in which case the sequencing bits have priority). Jog states always over-ride run.

[2] RFWD RREV: Run Fwd / Run Rev logic

		TB2 default pin number
Sequencing bit 0	Run forward	2
Sequencing bit 1	Jog	3
Sequencing bit 2	Run Reverse	4
Sequencing bit 3	Not used	

For the drive to run, parameter M08P01 (Stop input), and sequencing bit 0 or 2 must be set at 1.

To Jog forward or reverse, the Jog sequencing bit must be set at 1, together with the appropriate direction sequencing bit. Pressing the RUN, STOP and FWD-REV keys has no effect.

	[3] 2-WIRE: 2- wire logic Sequencing bit 0 Run TB2 default pin number 2 Sequencing bit 1 Jog 3 Sequencing bit 2 Reverse 4 Sequencing bit 3 Not used Read-only parameter M08B01 (Stop input) indicates that the drive is enabled or disabled. When M08B01 = 0, the drive is disabled. Sequencing bit 0 must be set at 1 for the drive to run. When sequencing bit 0 is set at 0 the drive stops. To jog forward or reverse the jog sequencing bit must be active together with the run bit and the appropriate direction selected. Because this mode requires signals to be continuously applied to the control signal terminals for the drive to run, the RUN, STOP and FWD-REV keys are inactive.		
M06B12 **M06B13** **M06B14**	**KEYPAD START** **KEYPAD STOP** **KEYPAD FWD/REV** When a key is pressed the related parameter is set at 1.	R-O	Range: 0 or 1 Default: 0
M06B15 **M06B16** **M06B17**	**EN KEYPAD RUN** **EN KEYPAD STOP** **EN KEYPAD FWD/RV** Use these parameters to enable or disable individual keys of the Control Keypad. When M06P18 is set at 0 and M01B08 (Keypad control) is set at 1, these parameters are automatically set at 1.	R-W	Range: 0 or 1 Default: 0
M06P18	**KEYPAD CONT MODE** Set at "NO KEYS" to disable M01B08 from controlling the Keypad Keys: M06B15, M06B16, and M06B17. [0] ALL KEYS M06B15, M06B16, and M06B17 controlled by M01P08. [1] NO KEYS M06B15, M06B16, and M06B17 not controlled by M01P08. [2] RUN & STOP M06B15 and M06B16 controlled by M01P08.	R-W	Range: [0] TO [2] Default: [2] RUN & STOP
M06B19	**HOLD ZERO SPEED** When this parameter is set to 1 the drive remains active even when the run command has been removed and the motor has reached standstill. The drive goes to the "ZERO HOLD" state instead of the "READY" state.	R-W	Range: 0 or 1 Default: 0
M06B20	**DISABL INPUTLOSS** This parameter is used only when the drive is operated from a 3-PHASE AC line supply to detect a phase loss or excessive voltage unbalance. This parameter is defaulted at 0 (enable input loss). If an INPUTLOSS fault occurs, check for excessive supply voltage unbalance or phase loss. This is a protective feature and it may be disabled temporarily only for diagnostic purposes.	R-W	Range: 0 or 1 Default: 0 (enable)

M06B21	**DISABL MOTORLOSS** This parameter is defaulted at 0 (enable motor loss). This feature is used to protect the drive. Disable only when running a drive without the motor connected for testing purposes and make sure to re-enable when testing is done. A MOTORLOSS fault is generated when the motor current is not detected or the motor current is below what it should be when the drive is in the RUN state.	R-W	Range: 0 or 1 Default: 0 (enable)
M06B22	**DISABLE FWD ROT** Set at 1 to prevent the drive producing forward rotation of the motor.	R-W	Range: 0 or 1 Default: 0
M06B23	**DISABLE REV ROT** Set at 0 to enable the drive to reverse the rotation of the motor.	R-W	Range: 0 or 1 Default: 1
M06B24	**MOTOR FLYCATCH** Set M06B24 at 1 to select this feature. Enable or disable drive flycatcher (catch a spinning motor) feature.	R-W	Range: 0 or 1 Default: 0
M06B25	**ZERO MOP AT STRT** When M06P25 is set at 1, and AC power is applied to the drive, the motorized potentiometer output is set at zero. When M06P25 is set at 0, and AC power is applied to the drive, the motorized potentiometer output returns to the level that existed when AC power was previously removed.	R-W	Range: 0 or 1 Default: 0
M06P26	**MOP RATE** The value in parameter M06P26 defines the time taken for the motorized potentiometer function to ramp from 0 to 100.0%. Twice this time will be taken to adjust the output from – 100.0% to +100.0%.	R-W	Range: 5 to 255 s/100% Default: 20
M06B27 **M06B28**	**MOP UP** **MOP DOWN** To control these motorized potentiometer parameters, two digital inputs must be programmed. Apply signals to these inputs to control the up and down functions.	R-W	Range: 0 or 1 Default: 0
M06B29	**BIPOLAR MOP** Set M06P29 at 1 to allow the motorized potentiometer to go negative, otherwise the output remains positive only.	R-W	Range: 0 or 1 Default: 0
M06P30	**MOP SCALE FACTOR** This parameter can be used to restrict the output of the motorized potentiometer to operate over a reduced range so that it can be used as a trim, for example.	R-W	Range: 0.000 to 10.000 Default: 1.000
M06P31	**MOP DESTINATION** Program the destination parameter that the motorized potentiometer is to control. If the motorized potentiometer is to control speed, it is suggested that one of the preset speed parameters is entered in M06P31. If the motorized potentiometer is to trim speed, it is suggested that M01P15 (offset parameter) is entered in M06P31. Factory defaulted to an unused parameter M00P00. Note: The scaling to the destination parameter is such that when M06P32 (MOP OUTPUT) = 100.0 %, and M06P30 (MOP SCALE FACTOR) = 1.000, the destination parameter will be set to its maximum value**.**	R-W	Range: MXXPXX Default: M00P00 (00.00)

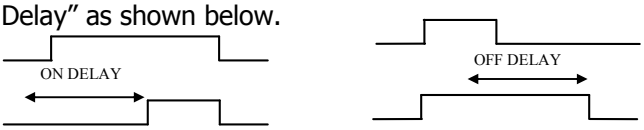
M06P32	**MOP OUTPUT** Saved at power down. This parameter indicates the current level of the motorized potentiometer. The value is saved when AC power is removed from the drive.	R-O	Range: ±100.00 % Default:
M06P38	**MINFLY STRT FREQ** Motor Flycatch Min Starting Search Frequency in % of Max Frequency (M01P06). The search always starts from the previous speed in which the drive last ran only if the speed was above the Min Starting Search Frequency. The Min Starting Search Frequency can be set at a higher level above set speed in applications where the motor is load-sharing or overhauled to make sure the search always starts at least at or above motor speed at the time of the search.	R-W	Range: 0-100% Default: 50%
M06B46	**EN KEYPAD EXTRIP** Set this parameter to 1 to enable the Control Keypad Stop/Reset key to cause an "EXTERNAL TRIP" fault if it is pressed twice rapidly within a one second interval. This feature, when enabled, is active in all sequencing modes for parameter M06P07 (SEQUENCING MODE). Additionally when this parameter is set to 1, the "KEYPDLOSS" fault detection is enabled regardless of the value for parameter M06B47 (EN KEYPAD LOSS).	R-W	Range: 0 or 1 Default: 0
M06B47	**EN KEYPAD LOSS** Set this parameter to 1 to enable the "loss of Control Keypad communications" fault. When this parameter is set to 1, a "KEYPDLOSS" fault will be generated if there is no communication detected between the Control Keypad and the drive for a time period equal to parameter M06P48 (KEYPAD TIMEOUT).	R-W	Range: 0 or 1 Default: 0
M06P48	**KEYPAD TIMEOUT** Period of time over which communications between the drive and the Control Keypad must be lost before a "KEYPDLOSS" fault is generated. See M06B47 for details.	R-W	Range: 0.2 to 3276.0 sec Default: 1.0
M06B49	**DISABLE MOD FLT** If the drive model is one that has parallel power modules, setting this parameter to "1" disables the power module check described under parameter M10P52 (MODULES DETECTED). Note that the Factory should be consulted before setting this parameter to "1".	R-W	Range: 0 or 1 Default: 0
M06B50	**KPAD SECURTY BYP** Keypad Security Bypass. If this parameter is set to "1", the user can still access parameter M01P04 (KEYPAD REFERENCE) when parameter M11P29 (SECURITY CODE) is set to a non-zero value. This allows an operator to use the **M**otor **O**perated **P**otentiometer (MOP) mode to control motor speed, but be locked-out from changing any other R/W parameters in the drive.	R-W	Range: 0 or 1 Default: 0
M07P01 **MO7P02** **MO7P03**	**ANALOG IN 1** **ANALOG IN 2** **ANALOG IN 3** Displays the amplitude of the signal applied to Analog input 1, 2, or 3. The scaling is such that when the voltage between the analog input terminal for the given analog	R-O	Range: ±100% for voltage input 0 to 100.0% for current input Default:

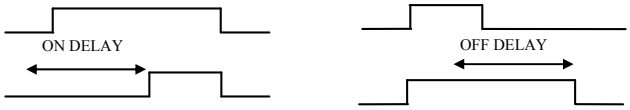
	input and common is 12.2 volts, the corresponding parameter above will read 100.0%. *Analog input 3 is optional.		
M07P06	**ANALOG OUT MODE** [0] NORMAL Normal analog output per user selection [1] SPD/TORQI Speed and torque current at high rate In NORMAL mode the analog outputs are user programmable using M07P07, M07P08 and M07P09. In SPD/TORQI mode analog 1 is set to speed and analog 2 is set to torque current. The outputs are updated at a fast rate. This is useful to fine-tune the drive control loops.	R-W	Range: [0] to [1] Default: [0] NORMAL
M07P07 **M07P08** **M07P09**	**ANALOG OUT 1 SRC** **ANALOG OUT 2 SRC** **ANALOG OUT 3 SRC** Enter the parameter number that is required to supply a value to Analog output 1, 2 or 3. * Analog output 3 is optional. Note for M07P07: The scaling of the source parameter is such that when it is at its maximum value and M07P20 (ANALOG OUT1 SCAL) = 1.000, +/- 10.00 volts will be present on ANALOG OUT 1. Note for M07P08: The scaling of the source parameter is such that when it is at its maximum value and M07P22 (ANALOG OUT2 SCAL) = 1.000, +/- 10.00 volts will be present on ANALOG OUT 2. Note for M07P09: The scaling of the source parameter is such that when it is at its maximum value and M07P24 (ANALOG OUT3 SCAL) = 1.000, +/- 10.00 volts will be present on ANALOG OUT 3.	R-W	Range: MXXPXX Default: M05P01 (05.01) M04P01 (04.01) M05P03 (05.03)
M07P10	**ANALOG IN 1 MODE** Set Display Mode [0] VOLT IN Voltage input [1] 0-20 MA 0 – 20 mA [2] 20-0 MA 20 – 0 mA [3] 4-20MA TP 4 – 20 mA Trip on current loop loss [4] 20-4MA TP 20 – 4 mA Trip on current loop loss [5] 4-20MA MS 4 – 20 mA Min speed current loop loss [6] 20-4MA MS 20 – 4 mA Min speed on current loop loss [7] 4-20MA LS 4 – 20 mA Last speed on current loop loss [8] 20-4MA LS 20 – 4 mA Last speed on current loop loss In 4-20mA and 20-4mA operation, the threshold for current-loop loss is 3mA. Read-only parameters and some other sensitive parameters (such as switching frequency) cannot be controlled using the analog inputs. When 0-20MA, 20-0MA, 4-20MA, or 20-4MA is used, wire the current signal to the on-board burden resistor at TB4-4 & TB4-5. Jumper TB4-4 to the either analog reference #1 (TB4-2) or analog reference #2 (TB4-3). The on-board burden resistor converts current to voltage before the signal is sent to analog reference #1 or #2.	R-W	Range: [0] to [8] Default: [0] VOLT IN

	If an inverse function is desired using 10V to 0V signal (10V = lower speed & 0V = upper speed), program ANALOG IN MODE to [2] 20-0MA and wire to analog reference #1 (TB4-2) or analog reference #2 (TB4-3) directly. Do not use the burden resistor in this case, since the signal is already a voltage.		
M07P11	**ANALOG IN 1 SCAL** Enter a value to scale Analog input 1. **NOTE:** In most cases, adjustment of M07P11, M07P14 and M07P17 is not necessary since the inputs are automatically scaled so that 100% input signal sets the destination parameter at 60 Hz. When a speed pot is used (wired as shown in Figure 2-5), You may want to set ANALOG IN 1 SCAL to 0.800 so that maximum pot travel corresponds to 60Hz (value of MAX FREQUENCY M01P06).	R-W	Range: 0 to 10.000 Default: 1.000
M07P12	**ANALOG IN 1 DEST** Enter the parameter that Analog input 1 is to control. Note: The scaling to the destination parameter is such that when M07P11 (ANALOG IN 1 SCAL) = 1.000 and ANALOG IN 1 is at its rated value (10.00 volts, 20 ma, 4ma or 0 ma depending on the value of M07P10 (ANALOG IN 1 MODE)), the destination parameter will be set to its maximum value.	R-W	Range: MXXPXX Default: M01P19 (01.19)
M07P13	**ANALOG IN 2 MODE** See parameter M07P10.	R-W	Range: [0] to [8] Default: [5] 4 to 20MA MS
M07P14	**ANALOG IN 2 SCAL** Enter a value to scale Analog input 2. See M07P11 for details.	R-W	Range: 0 to 10.000 Default: 1.000
M07P15	**ANALOG IN 2 DEST** Enter the parameter that Analog input 2 is to control. Note: The scaling to the destination parameter is such that when M07P14 (ANALOG IN 2 SCAL) = 1.000 and ANALOG IN 2 is at its rated value (10.00 volts, 20 ma, 4ma or 0 ma depending on the value of M07P13 (ANALOG IN 2 MODE)), the destination parameter will be set to its maximum value.	R-W	Range: MXXPXX Default: M01P20
M07P16	**ANALOG IN 3 MODE** See parameter M07P10. * Analog input 3 is optional.	R-W	Range: [0] to [8] Default: [0] VOLT IN
M07P17	**ANALOG IN 3 SCAL** Enter a value to scale Analog input 3. See M07P11 for details.	R-W	Range: 0 to 10.000 Default: 1.000
M07P18	**ANALOG IN 3 DEST** Enter the parameter that Analog input 3 is to control. Factory defaulted to an unused parameter M00P00. * Analog input 3 is optional. Note: The scaling to the destination parameter is such that when M07P17 (ANALOG IN 3 SCAL) = 1.000 and ANALOG IN 3 is at its rated value (10.00 volts, 20 ma,	R-W	Range: MXXPXX Default: M00P00 (00.00)

	4ma or 0 ma depending on the value of M07P16 (ANALOG IN 3 MODE)), the destination parameter will be set to its maximum value.		
M07P20	**ANALOG OUT1 SCAL** Enter a value to scale Analog output 1. **NOTE:** In most cases, adjustment of M07P20, M07P22 and M07P24 is not necessary since the output is automatically scaled so that 100% output signal is produced when the source parameter is at maximum.	R-W	Range: 0 to ±10.000 Default: 1.000
M07P22	**ANALOG OUT2 SCAL** Enter a value to scale Analog output 2.	R-W	Range: 0 to ±10.000 Default: 1.000
M07P24	**ANALOG OUT3 SCAL** Enter a value to scale Analog output 3. * Analog input 3 is optional.	R-W	Range: 0 to ±10.000 Default: 1.000
M07B25 **M07B26** **M07B27**	**CALIBRATE REF 1** **CALIBRATE REF 2** **CALIBRATE REF 3** When set at 1 the signal applied to analog input# 1, 2, or 3 is automatically scaled so that the applied input signal corresponds to the maximum value of the destination parameter times a multiplier. Example: ANALOG INPUT DESTINATION (M07P12) its destination is defaulted to ANALOG REFERENCE 1 (M01P19). When M07B25 is set to 1, the applied signal at analog input#1 at TB4-2 is automatically scaled to correspond to 60Hz (value of MAX FREQUENCY M01P06).	R-W	Range: 0 or 1 Default: 0
M08B01 **M08B02** **M08B03** **M08B04** **M08B05** **M08B06** **M08B07** **M08B08**	**F1 ENABLE –STOP INPUT** **F2 PROGRAM INPUT** **F3 PROGRAM INPUT** **F4 PROGRAM INPUT** **F5 PROGRAM INPUT** **F6 PROGRAM INPUT** **F7 PROGRAM INPUT** **F8 PROGRAM INPUT** Bit parameters M08B01 to M08B08 indicate the logic states of the programmable digital inputs F1 to F8 as follows: 0 = Inactive (logic 0) 1 = Active (logic 1) The input destination parameters (M08B09, etc.) define the parameter that the related programmable input (F2, etc.) is to control. Variable parameters, read-only parameters and Keypad control parameters (M06P12 to M06P14) cannot be controlled by the programmable digital inputs. <u>Note:</u> F1 (Enable/Stop) input is not programmable. When F1 input is open (de-energized) the drive will ramp stop in 3-wire control if the stopping mode is ramp-stop and always coast stops in 2-wire control regardless of the stopping mode.	R-O	Range: 0 or 1 Default:

M08P09	**F2 INPUT DESTINA** Enter the parameter number to use as the destination for input F2. Default: Sequencing bit 0 (run).	R-W	Range: MXXPXX Default: M06B08 (06.08)
M08B10	**F2 INVERT** Set to 1 to invert the logic sense of F2.	R-W	Range: 0 or 1 Default: 0
M08P11	**F3 INPUT DESTINA** Enter the parameter number to use as the destination for input F3. Default: Reset	R-W	Range: MXXPXX Default: M10B24 (10.24)
M08B12	**F3 INVERT** Set to 1 to invert the logic sense of F3.	R-W	Range: 0 or 1 Default: 0
M08P13	**F4 INPUT DESTINA** Enter the parameter number to use as the destination for input F4. Default: External Trip	R-W	Range: MXXPXX Default: M10B29 (10.29)
M08B14	**F4 INVERT** Set to 1 to invert the logic sense of F4.	R-W	Range: 0 or 1 Default: 0
M08P15	**F5 INPUT DESTINA** Enter the parameter number to use as the destination for input F5. Default: Sequencing bit 1 (Jog).	R-W	Range: MXXPXX Default: M06B09 (06.09)
M08B16	**F5 INVERT** Set to 1 to invert the logic sense of F5.	R-W	Range: 0 or 1 Default: 0
M08P17	**F6 INPUT DESTINA** Enter the parameter number to use as the destination for input F6. Default: Sequencing bit 2 (Reverse).	R-W	Range: MXXPXX Default: M06B10 (06.10)
M08B18	**F6 INVERT** Set to 1 to invert the logic sense of F6.	R-W	Range: 0 or 1 Default: 0
M08P19	**F7 INPUT DESTINA** Enter the parameter number to use as the destination for input F7. Default: Analog reference 2 select (Auto).	R-W	Range: MXXPXX Default: M01B21 (01.21)
M08B20	**F7 INVERT** Set to 1 to invert the logic sense of F7.	R-W	Range: 0 or 1 Default: 0
M08P21	**F8 INPUT DESTINA** Enter the parameter number to use as the destination for input F8. Default: Control Keypad select.	R-W	Range: MXXPXX Default: M01B08 (01.08)
M08B22	**F8 INVERT** Set to 1 to invert the logic sense of F8.	R-W	Range: 0 or 1 Default: 0
M08P23	**MODE SELECT SRC** Enter the bit parameter number to be used as a source for the mode selector. The mode selector is available to the user to change between any two modes of operation using only a bit parameter or a digital input. Factory defaulted to an unused parameter M00B00.	R-W	Range: MXXBXX Default: M00B00 (00.00)

M08P24	**MODESEL OUT DEST** Define the destination of the mode selector output. The destination must be a valid R-W mode parameter, a parameter with multiple choice. Factory defaulted to an unused parameter M00P00.	R-W	Range: MXXPXX Default: M00P00 (00.00)
M08P25	**MODE SELECT OUT** This parameter shows the selected mode output value of the mode selector output.	R-O	Range: [0] to [8] Default:
M08P26	**MODE SEL LOGIC 0** Enter the desired mode number when the mode selector source bit parameter is at logic 0	R-W	Range: [0] to [8] Default: [0]
M08P27	**MODE SEL LOGIC 1** Enter the desired mode number when the mode selector source bit parameter is at logic 1	R-W	Range: [0] to [8] Default: [1]
M09B01 **M09B02** **M09B03** **M09B04** **M09B05** **M09B06** **M09B07**	**DIGITAL OUTPUT 1** **DIGITAL OUTPUT 2** **DIGITAL OUTPUT 3** **DIGITAL OUTPUT 4** **DIGITAL OUTPUT 5** **DIGITAL OUTPUT 6** **DIGITAL OUTPUT 7** These parameters show the logic state of the 7 digital outputs. * Digital outputs 3 to 7 are optional.	R-O	Range: 0 or 1 Default: 0
M09P08	**BIT SEL1 SOURCE1** Enter the bit parameter number to be used as source 1 for bit selector 1. Factory defaulted to an unused parameter M00P00 which is equivalent to setting the source to 1.	R-W	Range: MXXBXX Default: M00B00 (00.00)
M09B09	**BIT SEL1 SR1 INV** Set at 1 to invert the logic state of source 1 for bit selector 1.	R-W	Range: 0 or 1 Default: 0
M09P10	**BIT SEL1 SOURCE2** Enter the bit parameter number to be used as source 2 for bit selector 1. Factory defaulted to an unused parameter M00P00 which is equivalent to setting the source to 1.	R-W	Range: MXXBXX Default: M00B00 (00.00)
M09B11	**BIT SEL1 SR2 INV** Set at 1 to invert the logic state of source 2 for bit selector 1.	R-W	Range: 0 or 1 Default: 0
M09B12	**BIT SEL1 OUT INV** Set at 1 to invert the logic state of bit selector 1 output.	R-W	Range: 0 or 1 Default: 0
M09P13	**BIT SEL 1 DELAY** Enter a value for the required delay for selector 1 output to become active (logic 1). If the parameter value is positive, the delay is an "ON Delay" as shown below. If the parameter value is negative, the delay is an "OFF Delay" as shown below.  	R-W	Range: 0 to ±3276.0 Sec Default: 0
M09P14	**BIT SEL2 SOURCE1** Enter the bit parameter number to be used as source 1 for	R-W	Range: MXXBXX Default: M00B00 (00.00)

	bit selector 2. Factory defaulted to an unused parameter M00P00 which is equivalent to setting the source to 1.		
M09B15	**BIT SEL2 SR1 INV** Set at 1 to invert the logic state of source 1 for bit selector 2.	R-W	Range: 0 or 1 Default: 0
M09P16	**BIT SEL2 SOURCE2** Enter the bit parameter number to be used as source 2 for bit selector 2. Factory defaulted to an unused parameter M00P00 which is equivalent to setting the source to 1.	R-W	Range: MXXBXX Default: M00B00 (00.00)
M09B17	**BIT SEL2 SR2 INV** Set at 1 to invert the logic state of source 2 for bit selector 2.	R-W	Range: 0 or 1 Default: 0
M09B18	**BIT SEL2 OUT INV** Set at 1 to invert the logic state of bit selector 2 output.	R-W	Range: 0 or 1 Default: 0
M09P19	**BIT SEL 2 DELAY** Enter a value for the required delay for selector 1 output to become active (logic 1). If the parameter value is positive, the delay is an "ON Delay" as shown below. If the parameter value is negative, the delay is an "OFF Delay" as shown below. 	R-W	Range: 0 to ±3276.0 Sec Default: 0
M09P20	**DIGITAL OUT3 SRC** Enter the bit parameter number to be used as source for digital output 3. The default setting indicates when drive is at below minimum frequency. * Digital outputs 3 to 7 are optional.	R-W	Range: MXXBXX Default: M10B04 (10.04)
M09B21	**DIGITAL OUT3 INV** Set at 1 to invert the logic state of digital output 3.	R-W	Range: 0 or 1 Default: 0
M09P22	**DIGITAL OUT4 SRC** Enter the bit parameter number to be used as source for digital output 4. The default setting indicates when the drive is At speed. * Digital outputs 3 to 7 are optional.	R-W	Range: MXXBXX Default: M10B05 (10.05)
M09B23	**DIGITAL OUT4 INV** Set at 1 to invert the logic state of digital output 4. * Digital outputs 3 to 7 are optional.	R-W	Range: 0 or 1 Default: 0
M09P24	**DIGITAL OUT5 SRC** Enter the bit parameter number to be used as source for digital output 5. The default setting indicates when the drive is in Current limit. * Digital outputs 3 to 7 are optional.	R-W	Range: MXXBXX Default: M10B08 (10.08)
M09B25	**DIGITAL OUT5 INV** Set at 1 to invert the logic state of digital output 5. * Digital outputs 3 to 7 are optional.	R-W	Range: 0 or 1 Default: 0

M09P26	**DIGITAL OUT6 SRC** Enter the bit parameter number to be used as source for digital output 6. The default setting indicates when Forward direction is demanded. * Digital outputs 3 to 7 are optional.	R-W	Range: MXXBXX Default: M10B13 (10.13)
M09B27	**DIGITAL OUT6 INV** Set at 1 to invert the logic state of digital output 6. * Digital outputs 3 to 7 are optional.	R-W	Range: 0 or 1 Default: 0
M09P28	**DIGITAL OUT7 SRC** Enter the bit parameter number to be used as source for digital output 7. The default setting indicates load reached. * Digital outputs 3 to 7 are optional.	R-W	Range: MXXBXX Default: M10B06 (10.06)
M09B29	**DIGITAL OUT7 INV** Set at 1 to invert the logic state of digital output 7. * Digital outputs 3 to 7 are optional.	R-W	Range: 0 or 1 Default: 0
M09P30	**DIGITAL OUT1 SRC** Enter the bit parameter number to be used as source for digital output 1. The default setting indicates when drive is running.	R-W	Range: MXXBXX Default: M10B02 (10.02)
M09B31	**DIGITAL OUT1 INV** Set at 1 to invert the logic state of digital output 1.	R-W	Range: 0 or 1 Default: 0
M09P32	**DIGITAL OUT2 SRC** Enter the bit parameter number to be used as source for digital output 2. The default setting indicates when drive is normal (not faulted).	R-W	Range: MXXBXX Default: M10B01 (10.01)
M09B33	**DIGITAL OUT2 INV** Set at 1 to invert the logic state of digital output 2.	R-W	Range: 0 or 1 Default: 0
M09P34	**BIT SEL1 OUTPUT** This parameter monitors the output of the bit selector 1.	R-O	Range: 0 or 1 Default:
M09P35	**BITSEL1 OUT DEST** Enter the destination for the output of the bit selector 1. Factory defaulted to an unused parameter M00B00.	R-W	Range: MXXBXX Default: M00B00 (00.00)
M09P36	**BIT SEL2 OUTPUT** This parameter monitors the output of the bit selector 2.	R-O	Range: 0 or 1 Default:
M09P37	**BITSEL2 OUT DEST** Enter the destination for the output of the bit selector 2. Factory defaulted to an unused parameter M00B00.	R-W	Range: MXXBXX Default: M00B00 (00.00)
M10B01	**DRIVE NORMAL** M10B01 = 0 indicates the drive is tripped. M10B01 = 1 indicates the drive is normal (not tripped),or if M10B28 = 1, the drive is tripped but an auto reset is going to occur.	R-O	Range: 0 or 1 Default:
M10B02	**DRIVE RUNNING** M10B02 = 1 indicates the output bridge of the drive is active.	R-O	Range: 0 or 1 Default: 0

M10B03	**AT ZERO SPEED** Open Loop: This parameter is set to 1 when the absolute value of the motor frequency (M05P01) is below the Zero Speed Threshold (M03P20) Closed Loop: This parameter is set to 1 when the absolute value of the speed feedback (M03P12) is below the Zero Speed Threshold (M03P20)	R-O	Range: 0 or 1 Default:
M10B04	**BELOW MIN SPEED** Open Loop: This parameter is set to 1 when the drive is running and the absolute value of the motor frequency is below the window defined by Minimum Frequency (M01P05). $\|M05P01\| \leq (\|M01P05\| + 1HZ)$ Closed Loop: This parameter is set to 1 when the drive is running and the absolute value of the speed feedback is below the window defined by Minimum Frequency (M01P05). $\|M03P12\| \leq (\|M01P05\| + 1HZ)$ Note: In bipolar mode (M01P10 = 1) this parameter is the same as At Zero Speed (M10P03).	R-O	Range: 0 or 1 Default:
M10B05	**AT SPEED** Open Loop: This parameter is set to 1 when the drive is running and the absolute value of the motor frequency (M05P01) is within the At speed band defined by M03P21 & M03P22 Closed Loop: This parameter is set to 1 when the drive is running and the absolute value of the speed feedback (M03P12) is within the At speed band defined by M03P21 & M03P22	R-O	Range: 0 or 1 Default:
M10B06	**LOAD REACHED** M10B06 = 1 indicates: Load current ≥ Rated load current Load current = torque component	R-O	Range: 0 or 1 Default: 0
M10B07	**IxT ALARM**	R-O	Range: 0 or 1 Default:

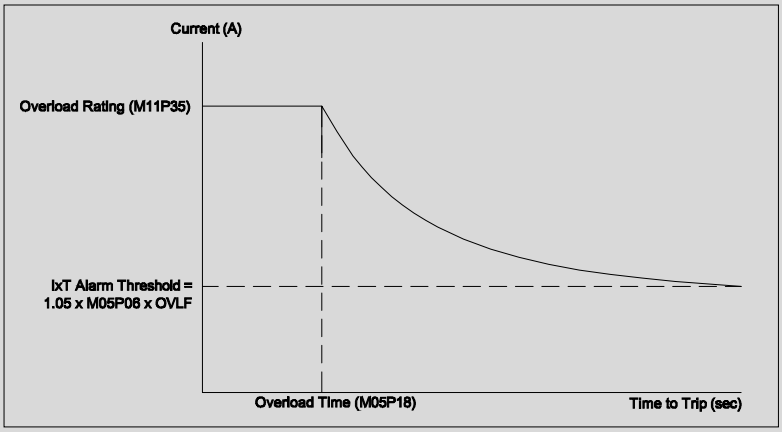


Figure 10-3 Time to Trip is Dependent on the Extent of Current Overload

M10B07 = 1 indicates that motor current is greater than the value defined by the speed sensitive overload "Continuous Operation Zone" (see Fig 10-3a). If the current is not reduced, the drive will trip on a MTR OVRLD fault after a period of time that depends on the extent of the overload.

The threshold level of motor current where M10B07 becomes set to "1" varies with motor speed (M05P01) and is calculated by:

$$\text{IxT Alarm Threshold} := 1.05 \cdot \text{M05P06} \cdot \text{OVLF}$$

Where

For $0 < \text{M05P01} < \text{M05P54}$

$$\text{OVLF} := \frac{1}{100} \cdot \left(\text{M05P55} + \frac{100 - \text{M05P55}}{\text{M05P54}} \cdot \text{M05P01} \right)$$

For $\text{M05P01} > \text{M05P54}$

$$\text{OVLF} := 1$$

Speed Sensitive Motor Overload

The Motor Overload protection is a fully programmable speed sensitive algorithm that complies with UL 508C sections 43.3, 43.4 and 43.5.

The SPEED SENSITIVE MOTOR OVERLOAD algorithm is setup using the following three(3) parameters:

M05P18 (OVERLOAD TIME)
M05P54 (IxT BREAK FREQ)
M05P55 (IxT ZER FRQ THLD)

By proper programming of these parameters, thermal protection for either general purpose self-cooled (TEFC) motors or Blower-Cooled (TENV) motors can be obtained.
The following RO status parameters can be used to monitor whether the motor is operating outside of the "Continuous Operation Zone" and how close the VFD is to tripping on a "MTR OVRLD" fault:

M10B07 (IxT ALARM) – set to "1" when motor is operating outside of the "Continuous Operation Zone"

M10P33 (IxT ACCUMULATOR) – "MTR OVRLD" fault occurs when value reaches

100.0% Also note that the keypad fault LED blinks whenever M10B07 (IxT ALARM) is set to "1" See Figure 10-3a. for graphical definition of the M05P54 (IxT BREAK FREQ) and M05P55 (IxT ZER FRQ THLD) parameters. These two parameters define the continuous operation zone of the motor. The M05P18 (OVERLOAD TIME) parameter determines how long the motor can run outside the continuous operation zone before it will thermally trip. **General purpose (TEFC) motors cannot run at high torque levels while at low speed continuously.** This is because the cooling for the motor is supplied by a fan that is driven by the motor shaft. As the speed of the motor decreases, the flow of air supplied by the fan decreases and the less cooling there is. For this type of motor, the proper motor thermal overload protection curve can be matched to the motor thermal time constant by setting the M05P55 (IxT ZERO FRQ THLD) parameter to 60.0% and the M05P54 (IxT BREAK FREQ) parameter to the M05P09 (BASE MOTOR FREQ) value. This means at zero speed the motor can safely draw 60.0% rated motor current indefinitely without overheating. At base speed, the motor can safely draw its full load rated current due to full cooling capability. See Figure 10-3c. **For Blower-Cooled (TENV) motors, running at high torque levels at low speed can be tolerated.** This is because the cooling for the motor is supplied by a separately powered blower that provides the same volume of cooling air, regardless of the motor speed. For this type of motor, the proper motor thermal overload protection curve can be matched to the motor thermal time constant by setting the M05P55 (IxT ZERO FRQ THLD) parameter to 100.0% and the M05P54 (IxT BREAK FREQ) parameter to the M05P09 (BASE MOTOR FREQ) value. This means at zero speed, the motor can safely draw 100% rated motor current indefinitely without overheating. Also, at base speed, the motor can safely draw its full load rated current due to full cooling capability. See Figure 10-3b.		

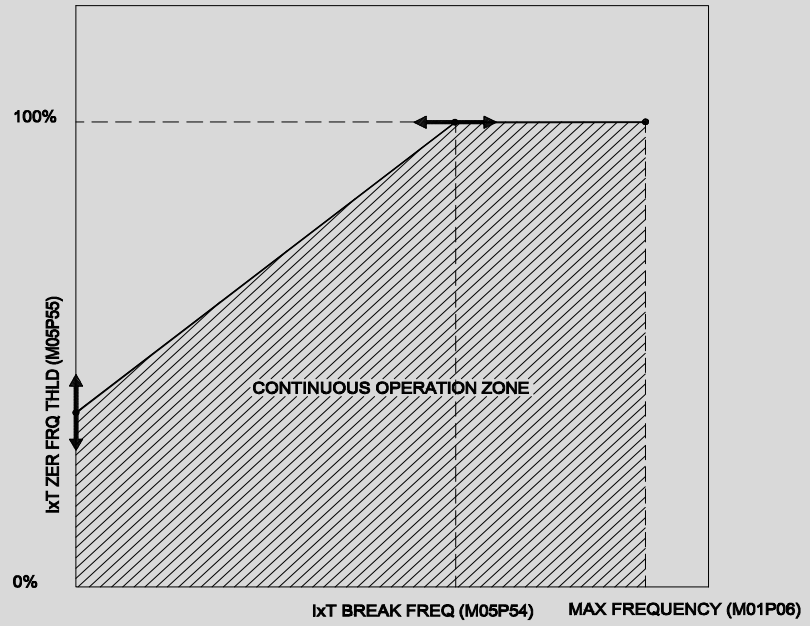


Figure 10-3a. Motor Thermal Continuous Operation Zone

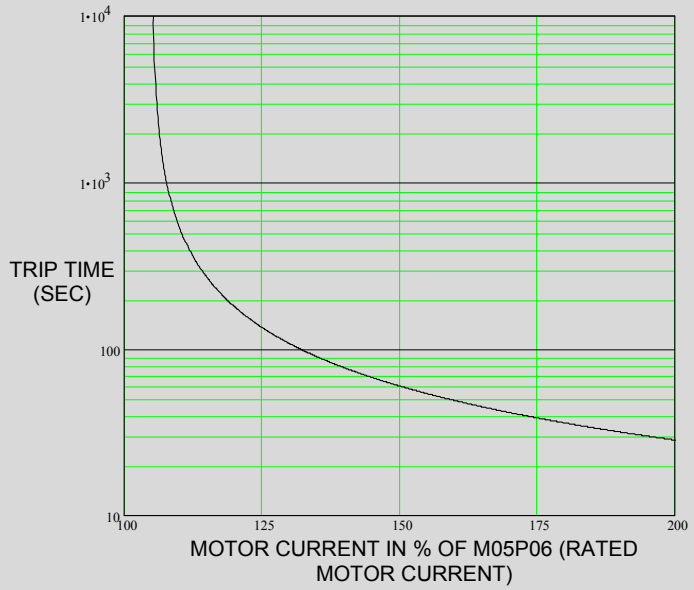


Figure 10-3b.
Thermal Trip Curve for Blower-Cooled (TENV) Motor

Conditions:
M05P18 (OVERLOAD TIME) = 60 SEC
M05P54 (IxT BREAK FREQ = 60.0 Hz
M05P55 (IxT ZER FRQ THLD) = **100.0 %**

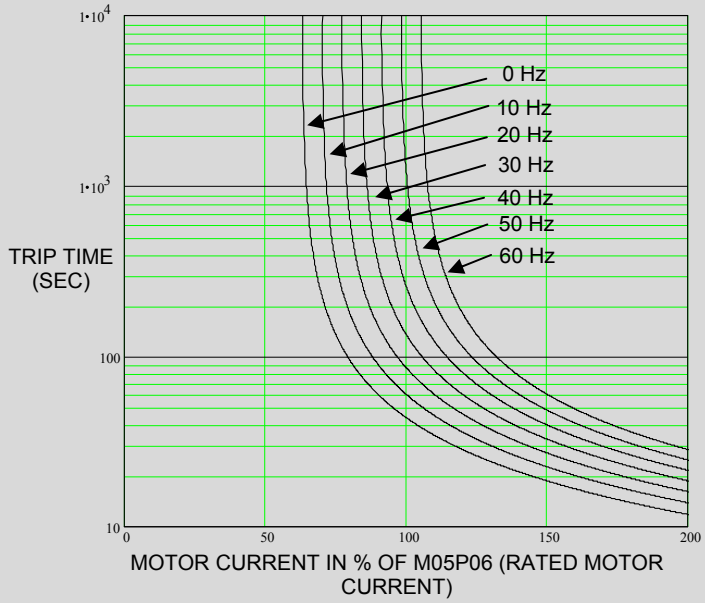


Figure 10-3c.
Motor Thermal Trip Curves for General Purpose (TEFC) Motor

Conditions:
M05P18 (OVERLOAD TIME) = 60 SEC
M05P54 (IxT BREAK FREQ = 60.0 Hz
M05P55 (IxT ZER FRQ THLD) = **60.0 %**

Time-to-Trip equation (in seconds):

$$TIMEtoTRIP := \frac{M05P18}{\left(\frac{\frac{MotorCurrent}{OVLF} - 1.05 \cdot M05P06}{M11P35 - 1.05 \cdot M05P06}\right)}$$

M05P18 is factory defaulted to 60 seconds.

To illustrate the speed sensitive nature of the motor overload trip time, consider the following examples:

Example 1: For D4-0500CT: M11P35 = 900A (150% rated drive 600x1.5) and:

M05P18 (OVERLOAD TIME) = 60.0 seconds
M05P54 (IxT BREAK FREQ) = 60.0 Hz
M05P55 (IxT ZER FRQ THLD) = 60.0 %

If a user enters 600A in M05P06 and if the motor is running at 900A motor current and at a speed (M05P01) of 60.0 Hz:

$$OVLF := \frac{1}{100} \cdot \left(60 + \frac{100 - 60}{60} \cdot 60\right) \qquad OVLF = 1$$

$$TIMEtoTRIP := \frac{60}{\left(\frac{\frac{900}{1.0} - 1.05 \cdot 600}{900 - 1.05 \cdot 600}\right)} \qquad TIMEtoTRIP = 60$$

Example 2: Same as example 1, but the motor is instead running at a speed (M05P01) of 30.0 Hz:

$$OVLF := \frac{1}{100} \cdot \left(60 + \frac{100 - 60}{60} \cdot 30\right) \qquad OVLF = 0.8$$

$$TIMEtoTRIP := \frac{60}{\left(\frac{\frac{900}{0.8} - 1.05 \cdot 600}{900 - 1.05 \cdot 600}\right)} \qquad TIMEtoTRIP = 32.727$$

Example3: Same as example 1, but the motor is instead running at a speed (M05P01) of 0.0 Hz:

$$OVLF := \frac{1}{100} \cdot \left(60 + \frac{100 - 60}{60} \cdot 0.0\right) \qquad OVLF = 0.6$$

$$TIMEtoTRIP := \frac{60}{\left(\frac{\frac{900}{0.6} - 1.05 \cdot 600}{900 - 1.05 \cdot 600}\right)} \qquad TIMEtoTRIP = 18.621$$

M10B08	**AT CURRENT LIMIT** M10B08 = 1 indicates the normal current limit is active.	R-O	Range: 0 or 1 Default: 0
M10B09	**MOTOR IN REGEN** M10B09 = 1 indicates the output bridge is transferring power from the motor to the DC bus.	R-O	Range: 0 or 1 Default: 0
M10B10	**ABOVE SET SPEED** Open Loop: This parameter is set to 1 when the drive is running and the absolute value of the motor frequency (M05P01) is above the At Speed window as defined by M03P22 and M03P27 Closed Loop: This parameter is set to 1 when the drive is running and the absolute value of the speed feedback (M03P12) is above the At Speed window defined by M03P22 and M03P27	R-O	Range: 0 or 1 Default:
M10B11	**BELOW SET SPEED** Open Loop: This parameter is set to 1 when the drive is running and the absolute value of the motor frequency (M05P01) is below the At Speed window as defined by M03P21 and M03P27 Closed Loop: This parameter is set to 1 when the drive is running and the absolute value of the speed feedback (M03P12) is below the At Speed window defined by M03P21 and M03P27	R-O	Range: 0 or 1 Default:
M10B12	**PG LOSS** Closed loop parameter M10B12 = 1 indicates PG loss as described in M03P07.	R-O	Range: 0 or 1 Default:
M10B13	**FWD ROTATIO EN** M10B13 = 1 indicates the pre-ramp reference is positive.	R-O	Range: 0 or 1 Default 0

M10P14 **M10P15** **M10P16** **M10P17** **M10P18** **M10P19** **M10P20** **M10P21** **M10P22** **M10P23**	**LAST FAULT** **RECORDED FAULT#1** **RECORDED FAULT#2** **RECORDED FAULT#3** **RECORDED FAULT#4** **RECORDED FAULT#5** **RECORDED FAULT#6** **RECORDED FAULT#7** **RECORDED FAULT#8** **RECORDED FAULT#9** These parameters indicate Recorded Fault#1 is most recent.	R-O	Range: Default:
M10B24	**DRIVE RESET** Set at 1 to reset the drive. If the drive is to be reset by an input signal, a programmable digital input must be programmed to control this parameter. F3 input destination default is M10B24.	R-W	Range: 0 or 1 Default: 0
M10B25	**ENABLE AUTORESET** If set to 1, the drive will automatically reset trips when tripped after a programmed delay set in M10P26 "RESET DELAY". Auto-reset function resets only the faults as specified in parameter M10P35 "AUTORESET MODE".	R-W	Range: 0 or 1 Default: 0
M10P26	**AUTORESET DELAY** Enter the auto-reset delay in seconds. This parameter defines the time between a trip and an auto-reset.	R-W	Range: 0 to 3276.0 Sec Default: 5
M10P27	**NO OF AR ATTEMPTS** If this parameter is set to zero then no auto-reset attempts are made. Any other value will cause the drive to automatically reset following a trip. When the programmed value of M10P27 is reached, any further trips of the same type will not cause an auto-reset. A trip of a different type will cause an auto-reset. If there has been no trip for 10 minutes then the reset count is cleared.	R-W	Range: 0 to 10 Default: 0
M10B28	**VFD OK DELAYED** This parameter can be used to hold "Drive Normal" status bit M10B01 at 1 until the last Auto-Reset Attempt is used. Set M10B28 to 1 for "Drive Normal" status bit M10B01 to remain set at 1 every time a trip occurs and "Auto-Reset" is going to occur. Set M10B28 to 0 to immediately clear "Drive Normal" status bit M10B01 at 0 every time a trip occurs, regardless of any Auto-reset that may occur.	R-W	Range: 0 or 1 Default: 1
M10B29	**EXTERNAL TRIP** When an external trip signal is required to control this parameter, use a programmable digital input and ensure that the input state is at logic 1 to prevent the drive tripping. M10B29 = 0 the drive will trip. F4 input destination fault is M10B29.	R-W	Range: 0 or 1 Default: 1
M10P30	**SERIAL TRIP** Parameter M10P30 can be accessed by the serial port to	R-W	Range: 68 to 69 Default: 0

trip the drive and display a relevant trip code.

When trip codes 68 or 69 are entered into M10P30, the trip message, "SER TRIP1" or "SER TRIP2" respectively, will be shown and the drive will trip.

The drive can be reset by setting M10P30 at 70.

M10P31 STATUS WORD — R-O — Range: 0 to 32761, Default: 0

Parameter M10P31 contains a binary coded number. This indicates the current state of the read-only parameters that indicate the status of the drive. The coded number can be used to control indicators on a separate display panel. When this parameter is viewed on the Real-time Operator Module (ROM), it is displayed as a hexadecimal number.

The binary codes that are produced when the parameters are at logic 1 are as follows:

Parameter Number	Parameter Name	Description	Binary
M10B01	DRIVE NORMAL	Drive normal (not tripped)	2^0
M10B02	DRIVE RUNNING	Drive is running	2^1
M10B03	AT ZERO SPEED	Zero frequency or stopped	2^2
M10B04	BELOW MIN SPEED	Running at or below minimum frequency	2^3
M10B05	AT SPEED	Drive running at set speed	2^4
M10B06	LOAD REACHED	Load reached	2^5
M10B07	IxT ALARM	IxT motor overload	2^6
M10B08	AT CURRENT LIMIT	Drive output is at current limit	2^7
M10B09	MOTOR IN REGEN	Motor regenerating	2^8
M10B10	ABOVE SET SPEED	Drive running above set speed	2^9
M10B11	BELOW SET SPEED	Drive running below set speed	2^{10}
M10B12	PG LOSS	PG loss (encoder loss)	2^{11}
M10B13	FWD ROTATIO EN	Forward rotation commanded	2^{12}
M10B25	ENABLE AUTORESET	Enable auto-reset	2^{13}
M10B34	CLOSED LP STATUS	Drive in Closed Loop operation	2^{14}
M10B36	MOTOR 2 SELECTED	Drive is using 2nd Motor (map) parameters	2^{15}

M10P32 DRIVE STATUS — R-O — Range: [0] to [9], Default:

This parameter indicates the drive status

[0]	READY	
[1]	RUNNING	Drive run state
[2]	RAMP STOP	Drive ramp stop state
[3]	DISABLED	Drive is disabled
[4]	FLYCATCH	Drive is catching a spinning motor
[5]	DC INJECT	Drive in DC injection braking state
[6]	FAULT	Drive tripped
[7]	RESET	Drive reset
[8]	ZERO HOLD	Drive active and holding zero speed
[9]	ORIENT	Orientation state

M10P33 IxT ACCUMULATOR — R-O — Range: 0.0 to 100.0 %, Default:

When the motor current exceeds 105% of the programmed Motor Rated Current (M00P03 or M05P06), the IxT accumulator will display a value greater than 0. If the current is not reduced the accumulator value will eventually reach 100 % and the drive will trip on IxT overload fault.

When the accumulator value is greater than 0 the IxT Alarm parameter bit (M10B07) is set at 1 and the keypad fault LED blinks.

M10B34	**CLOSED LP STATUS** M10B34 = 1 indicates the drive in Closed Loop operation.	R-O	Range: 0 or 1 Default:
M10P35	**AUTORESET MODE** Use this parameter to select how parameter M10B25 "ENABLE AUTORESET" function operates. Select from: [0] PWR LOSS Reset undervoltage and overvoltage faults only [1] ALLFAULTS Reset all faults	R-W	Range: [0] to [1] Default: [0] PWR LOSS
M10B36	**MOTOR 2 SELECTED** M10B36 = 1 indicates that the 2nd Motor (Map) parameters are active.	R-O	Range: 0 or 1 Default: 0
M10B37	**IN RAMP STOP** M10B37 = 1 indicates the drive is in the RAMP STOP state (Drive is ramping down to a stop) as indicated by parameter M10P32 (DRIVE STATUS).	R-O	Range: 0 or 1 Default:
M10B38	**DRIVE DISABLED** M10B38 = 1 indicates the drive is in the DISABLED state as indicated by parameter M10P32 (DRIVE STATUS).	R-O	Range: 0 or 1 Default:
M10B39	**IN FLYCATCH** M10B39 = 1 indicates the drive is in the FLYCATCH state as indicated by parameter M10P32 (DRIVE STATUS).	R-O	Range: 0 or 1 Default:
M10B40	**IN DC INJECT** M10B40 = 1 indicates the drive is in the DC INJECT state as indicated by parameter M10P32 (DRIVE STATUS).	R-O	Range: 0 or 1 Default:
M10B41	**IN ZERO HOLD** M10B41 = 1 indicates the drive is active and holding zero speed.	R-O	Range: 0 or 1 Default:
M10B42	**IN ORIENTATION** M10B42 = 1 indicates the drive is in the orientation state.	R-O	Range: 0 or 1 Default:
M10B43	**SERIAL LOSS** M10B43 = 1 indicates a serial communications loss as described in M11P43.	R-O	Range: 0 or 1 Default:
M10B44	**BRAKE APLY ALARM** M10B44 = 1 indicates a "BRAKE APLY" alarm is active.	R-O	Range: 0 or 1 Default:
M10P52	**MODULES DETECTED** For drive models that have parallel power modules and where parameter M06B49 (DISABLE MOD FLT) is set to "0", the number of power modules detected on the ribbon cable bus (modules "on line") is indicated. The drive scans continually for the number of power modules "on line" if it is not in the "RUN" state. If parameter M10P52 does not equal parameter M11P46 (MODULES REQUIRED), a "# OF MODS" fault is generated. If the drive model is not one that has parallel power modules or parameter M06B49 is set to "1", this parameter is set to "0". Note that there are a number of causes for the "# OF MODS" fault to be generated. See the Fault Description Section for a full explanation of the "# OF MODS" fault.	R-O	Range: 1 to 6 Default:
M11P01 to M11P20	**DEFINE M00PXX** Use the Menu 11 parameters in the following table to assign parameters in the Advanced menus to the User menu (Menu 0). The default assignments are shown.	R-W	Range: Default:

	The Menu 11 parameters in the table are read-write. Parameter number / Menu 0 User parameter / Default assignment M11P01 M05P08 RATED MOTOR VOLT M11P02 M05P09 RATED MOTOR FREQ M11P03 M05P06 RATED MOTOR CURR M11P04 M05P10 NUMBER OF POLES M11P05 M04P11 SYM CURRENT LIM M11P06 M02P03 ACCEL RAMP 1 M11P07 M02P04 DECEL RAMP 1 M11P08 M01P06 MAX FREQUENCY M11P09 M01P05 MIN FREQUENCY M11P10 M05P33 RATED LINE VOLTS M11P11 M11P27 SOFTWARE VERSION M11P12 M11P33 DRIVE MODEL NO M11P13 M05P03 MOTOR VOLTAGE M11P14 M05P05 MOTOR POWER M11P15 M05P04 DC BUS VOLTAGE M11P16 M05P34 AC LINE VOLTAGE M11P17 M10P14 LAST FAULT M11P18 M04P01 MOT CURR-TOTAL M11P19 M01P03 FINAL FREQ REF M11P20 M05P02 MOTOR SHAFT RPM For parameters programmed into M11P19 and M11P20, a scale factor can be applied using M11P21 and M11P22 in order to indicate some meaningful unit such as gallons per minute. Also a text can be applied using M11P31 & M11P32.		
M11P21	**SCALE FOR M00P19** Enter a value to scale M00P19 to represent a meaningful unit, such as gallons per minute. To change text use parameter M11P31.	R-W	Range: 0.0 to ±10.000 Default: 1.000
M11P22	**SCALE FOR M00P20** Enter a value to scale M00P20 to represent a meaningful unit, such as gallons per minute. To change text use parameter M11P32.	R-W	Range: 0.0 to ±10.000 Default: 1.000
M11P23	**SERIAL ADDRESS** Enter an address for serial communications.	R-W	Range: 1 to 255 Default: 1
M11P24	**SERIAL PARITY** Select the required mode of operation for serial communications. [0] NO PARITY No Parity [1] OD PARITY Odd Parity [2] EV PARITY Even Parity	R-W	Range: [0] to [2] Default: [0] NO PARITY
M11P25	**BAUD RATE** [0] = 4800 BAUD [1] = 9600 BAUD [2] = 19.2 KBD	R-W	Range: [0] to [2] Default: [1] 9600 BAUD
M11P26	**SERIAL PROTOCOL** Use this parameter to select the serial protocol. [0] MODBUSUSD Modbus US Drives Protocol [1] METASYSN2 Johnson Controls Metasys N2 Protocol [2] MODBUSRTU Modbus RTU Protocol	R-W	Range: [0] to [2] Default: [0] MODBUSUSD

M11P27	**SOFTWARE VERSION** Indicates version of software in the drive.	R-O	Range: XXXX Default:
M11P28	**PROCESSOR 2 VER** Indicates software version present on any optional card fitted.	R-O	Range: XXXX Default:
M11P29	**SECURITY CODE** User can create his own security code using a four-digit number to lock parameter editing. For more details refer to section 3.4.8	R-W	Range: 0 to 9999 Default: 0
M11P30	**DISPLAY WHEN PWR** Enter the number of the parameter that is to be displayed when AC power is applied. By setting parameter M11P30 equal to "99.99", parameters M00P19 and M00P20 will be displayed simultaneously on the top and bottom lines of the keypad display respectively. Depending on the data type of the parameters selected for M00P19 and M00P20, the text string for the displayed parameters maybe truncated to fit into the upper and lower 16 character lines.	R-W	Range: M00P00 to M00P20 Default: M00P20 (00.20)
M11P31	**TEXT FOR M00P19** Use this parameter to change parameter M00P19 text. When scrolling through the list [0] to [20], the text choice will be shown on the text field (upper row). When the Enter key is hit, the chosen text will be the text for M00P19 and the M11P31 text field will revert to show TEXT FOR M00P19. Note: When [0] is selected the M00P19 text is the text of the parameter assigned to M00P19. [0] * [1] CURRENT (Can be edited using Drive Master) [2] CURRENT [3] FEEDBACK [4] FLOW [5] FREQUENCY [6] INPUT [7] LOAD [8] OUTPUT [9] POWER [10] PRESSURE [11] REFERENCE [12] SETPOINT [13] SPEED [14] TEMPERATURE [15] TENSION [16] TORQUE [17] VOLTAGE [18] VOLUME [19] STATUS [20] MODE *Text is the text of the parameter assigned to M00P19.	R-W	Range: [0] to [20] Default: [0]
M11P32	**TEXT FOR M00P20** Use this parameter to change parameter M00P20 text. When scrolling through the list [0] to [20], the text choice	R-W	Range: [0] to [20] Default: [0]

	will be shown on the text field (upper row). When the Enter key is hit, the chosen text will be the text for M00P20 and the M11P32 text field will revert to show TEXT FOR M00P20. Note: When [0] is selected the M00P20 text is the text of the parameter assigned to M00P20. [0] * [1] CURRENT [2] CURRENT (Can be edited using Drive Master) [3] FEEDBACK [4] FLOW [5] FREQUENCY [6] INPUT [7] LOAD [8] OUTPUT [9] POWER [10] PRESSURE [11] REFERENCE [12] SETPOINT [13] SPEED [14] TEMPERATURE [15] TENSION [16] TORQUE [17] VOLTAGE [18] VOLUME [19] STATUS [20] MODE *Text is the text of the parameter assigned to M00P20.		
M11P33	**DRIVE MODEL NO** Indicates the drive model number.	R-W	Range: Default:
M11P34	**VOLTAGE RATING** Indicates the voltage rating of the drive. [0] 200 – 250V = Low voltage range [1] 380 – 500V = Standard voltage range [2] 500 – 600V = High Voltage	R-O	Range: [0] to [2] Default:
M11P35	**OVERLOAD RATING** Indicates maximum overload current in Amps of the drive. Note: • For dual rated drives, the overload rating is 1.2 times the VT Output Current Rating for the given drive model listed in tables 1-1 thru 1-3. • For VT only rated drives, the overload rating is 1.2 times the Output Current Rating for the given drive model listed in tables 1-1 thru 1-3. • For CT only rated drives, the overload rating is 1.5 times the Output Current Rating for the given drive model listed in tables 1-1 thru 1-3.	R-O	Range: Default:
M11P36	**FACTORY DEFAULTS** [0] NO [1] YES To set all parameter to the factory defaults	R-W	Range: [0] to [1] Default: NO
M11P37	**ACCESS CODE** User to enter access code to unlock parameter editing. For more details refer to section 3.4.8	R-W	Range: 0 to 10000 Default: 0

M11P38	**DRIVE TYPE** [0] OPEN LOOP Open loop vector (sensorless) [1] CLOSED LP Closed loop vector (with speed feedback)	R-W	Range: [0] or [1] Default: [0] OPEN LOOP
M11B40	**SELECT 2nd MOTOR** Set at 1 to select the 2nd Motor (map) parameters. This parameter is read-only (R-O) while the drive is running.	R-W	Range: 0 or 1 Default: 0
M11B41	**EN SERIAL LOSS** Set this parameter to 1 to enable the "loss of serial communications" warning or fault. When this parameter is set to 1, a "SERIALOSS" warning or fault will be generated once communication from the master is lost by the slave (drive) for a time period equal to parameter M11P42 (SERIAL TIMEOUT). Note that a serial loss can only occur after communication has been established between the master and the drive (slave). The drive waits for the master to initiate communication. See M11P43 for details.	R-W	Range: 0 or 1 Default: 0
M11P42	**SERIAL TIMEOUT** Period of time over which communications between the master and the slave (drive) must be lost before a "SERIALOSS" warning or fault is generated. See M11P43 for details.	R-W	Range: 0.2 to 3276.0 sec Default: 10.0
M11P43	**SERIAL LOSS MODE** Set to determine the stopping method or Alarm only when a serial loss (SERIALOSS) is detected. A "SERIALOSS" warning or fault will be generated once communication from the master is lost by the slave (drive) for a time period equal to parameter M11P42 (SERIAL TIMEOUT). [0] COASTSTOP Coast stop when serial loss detected [1] RAMP STOP Ramp stop when serial loss detected [2] ALARMONLY Alarm only when serial loss detected [0] Coast Stop: A serial loss will cause the motor to coast stop and set a "SERIALOSS" fault. In this mode M10B01 "Drive Normal" parameter is set to 0 indicating drive tripped. [1] Ramp Stop: A serial loss will cause the motor to ramp stop and set a "SERIALOSS" fault. In this mode M10B01 "Drive Normal" parameter is set to 0 indicating drive tripped at the end of ramp stop. [2] Alarm Only: A serial loss will cause the drive to continue running and will display an "ALARM MESSAGE SERIALOSS" message. In this mode M10B01 (Drive Normal) is kept set to 1 indicating Drive Normal (not tripped). In all modes when a serial loss is detected, the M10B43 SERIAL LOSS status bit is set to 1. M10B43 is cleared when a reset is initiated via Stop/Reset Control Keypad Key or digital input Reset via the terminal block.	R-W	Range: [0]-[2] Default: [0] COASTSTOP
M11P44	**ENABL SERIAL R/W** [0] NO To Disable Serial R/W of Parameters [1] YES To Enable Serial R/W of Parameters	R-W	Range: [0] to [1] Default: [1] YES

	Use this parameter to disable editing parameters via serial communications. When disabled only R/O (read only) parameters can be viewed. For more details refer to section 3.4.8		
M11P45	**EN SER BROADCAST** [1] YES [0] NO Set this parameter at 0 to ignore a serial communications broadcast command. Note that a broadcast command is only a Write command.	R-W	Range: [0] to [1] Default: YES
M11P46	**MODULES REQUIRED** Based on the drive model (M11P33), this parameter is set to the number of parallel power modules required. For non-parallel power module models, this parameter is set to "1".	R-O	Range: 1 to 6 Default:
M11B47	**SERIAL RUN ENABL** Set this parameter to "1" to enable control of the drive by way of the serial port. When this parameter is set to "1", a number of parameters are re-programmed depending on the setting of parameter M11P48 (SERIAL CTRL MODE). See M11P48 for details.	R-W	Range: 0 or 1 Default: 0
M11P48	**SERIAL CTRL MODE** This parameter determines which parameters are re-programmed when parameter M11B47 (SERIAL RUN ENABL) is set to "1" and thereafter when it is set to "0" [0] MODE 1 Serial control with Auto/Hand control and with serial and keypad timeouts: <u>M11B47 = 1:</u> M01B07(SEL PRESET SPEED) = 1 M08P09(F2 INPUT DESTINA) = 0.0 M08P23(MODE SELECT SRC) = 8.08 M08P24(MODESEL OUT DEST) = 6.07 M08P26(MODE SEL LOGIC 0) = 3 M08P27(MODE SEL LOGIC 1) = 0 M09P08(BIT SEL1 SOURCE1) = 8.08 M09B12(BIT SEL1 OUT INV) = 1 M09P14(BIT SEL2 SOURCE1) = 8.08 M09P35(BITSEL1 OUT DEST) = 11.41 M09P37(BITSEL2 OUT DEST) = 6.47 <u>M11B47 = 0:</u> M01B07(SEL PRESET SPEED) = 0 M08P09(F2 INPUT DESTINA) = 6.08 M08P23(MODE SELECT SRC) = 0.0 M08P24(MODESEL OUT DEST) = 0.0 M08P26(MODE SEL LOGIC 0) = 0 M08P27(MODE SEL LOGIC 1) = 0 M09P08(BIT SEL1 SOURCE1) = 0.0 M09B12(BIT SEL1 OUT INV) = 0 M09P14(BIT SEL2 SOURCE1) = 0.0 M09P35(BITSEL1 OUT DEST) = 0.0 M09P37(BITSEL2 OUT DEST) = 0.0 M11B41(EN SERIAL LOSS) = 0	R-W	Range: [0] TO [3] Default: [3] DISABLE

		M06B47(EN KEYPAD LOSS) = 0 M06P07(SEQUENCING MODE) = 2OR3 WIRE		
	[1] MODE 2	Serial control with Auto/Hand control <u>without</u> serial and keypad timeouts: <u>M11B47 = 1:</u> M01B07(SEL PRESET SPEED) = 1 M08P09(F2 INPUT DESTINA) = 0.0 M08P23(MODE SELECT SRC) = 8.08 M08P24(MODESEL OUT DEST) = 6.07 M08P26(MODE SEL LOGIC 0) = 3 M08P27(MODE SEL LOGIC 1) = 0 <u>M11B47 = 0:</u> M01B07(SEL PRESET SPEED) = 0 M08P09(F2 INPUT DESTINA) = 6.08		
	[2] MODE 3	Simple serial control <u>without</u> serial And keypad timeouts: <u>M11B47 = 1:</u> M01B07(SEL PRESET SPEED) = 1 M08P09(F2 INPUT DESTINA) = 0.0 M06P07(SEQUENCING MODE) = 2-WIRE <u>M11B47 = 0:</u> M01B07(SEL PRESET SPEED) = 0 M08P09(F2 INPUT DESTINA) = 6.08 M06P07(SEQUENCING MODE) = 2OR3 WIRE		
	[3] DISABLE	Disable any parameter changes when parameter M11B47 (SERIAL RUN ENABL) is set to "1" or when it is set to "0"		
M12B01	**THRSLD 1 EXCEEDED** M12B01 = 1 indicates input variable is above Threshold 1. M12B01 = 0 indicates input variable is below Threshold 1.		R-O	Range: 0 or 1 Default: 0
M12B02	**THRSLD 2 EXCEEDED** M12B02 = 1 indicates input variable is above Threshold 2. M12B02 = 0 indicates input variable is below Threshold 2.		R-O	Range: 0 or 1 Default:
M12P03	**THRESHOLD 1 SRC** Enter the number of the parameter to be used as the source for threshold 1. The absolute value of the source is taken as the input to the Threshold comparator. Factory defaulted to an unused parameter M00P00. <u>Note:</u> The source parameter input to the threshold detector is scaled such that when the source parameter is at its maximum value, it represents a 100 % input to threshold detector 1.		R-W	Range: MXXPXX Default: M00P00 (00.00)

M12P04	**THRESHOLD1 LEVEL** User-defined threshold 1 level entered as a percentage of the source maximum.	R-W	Range: 0.0 to 100.0 % Default: 0
M12P05	**THRESHOLD1 HYST** Defined band where no change will occur to the comparator output. Upper limit for switching: Level + [hyst ÷ 2] Lower limit: Level – [hyst ÷ 2]	R-W	Range: 0 to 25.5 % Default: 0
M12B06	**THRSHLD1 OUT INV** Set at 1 to invert threshold comparator 1 output.	R-W	Range: 0 or 1 Default: 0
M12P07	**THRESHOLD1 DEST** Define the destination of the threshold comparator 1 output. The destination must be a R-W bit parameter. A new value entered in M12P07. Factory defaulted to an unused parameter M00P00.	R-W	Range: MXXPXX Default: M00P00 (00.00)
M12P08	**THRESHOLD2 SRC** Refer to the notes for M12P03 to M12P07. Factory defaulted to an unused parameter M00P00 which is equivalent to setting the source signal to 0. Note: The source parameter input to the threshold detector is scaled such that when the source parameter is at its maximum value, it represents a 100 % input to threshold detector 2.	R-W	Range: MXXPXX Default: M00P00 (00.00)
M12P09	**THRESHOLD2 LEVEL** Refer to the notes for M12P03 to M12P07.	R-W	Range: 0.0 to 100.0 % Default: 0
M12P10	**THRESHOLD2 HYST** Refer to the notes for M12P03 to M12P07.	R-W	Range: 0 to 25.5 % Default: 0
M12B11	**THRSHLD2 OUT INV** Refer to the notes for M12P03 to M12P07.	R-W	Range: 0 or 1 Default: 0
M12P12	**THRESHOLD2 DEST** Refer to the notes for M12P03 to M12P07. Factory defaulted to an unused parameter M00P00. Factory defaulted to an unused parameter M00P00.	R-W	Range: MXXPXX Default: M00P00 (00.00)
M12P13	**VAR SEL1 IN1 SRC** Enter the source for variable selector 1 input 1. There are two variable selectors available to the user. Each variable selector allows two input parameter values defined by (M12P13, M12P14) & (M12P23, M12P24) to be manipulated as defined by the mode M12P15 & M12P25. The result of the input parameters is limited by (M12P21, M12P22) & (M12P31, M12P32) and routed to a destination parameter defined M12P16 & M12P26. This feature is useful to reroute, smooth & combine any variable parameter. The end result can be used for display or monitoring purposes, or can be as an input to another parameter or function. Please refer to Menu 12 flowchart in the previous section of the instruction manual. Note: The scaling of the source parameter is such that when it is at its maximum value, and M12P18 (VEL1 IN1 SCALE) = 1.000, the IN1 input to VAR SEL 1 is at 100 %.	R-W	Range: MXXPXX Default: M00P00 (00.00)

M12P14	**VAR SEL1 IN2 SRC** Enter the source for variable selector 1 input 2. See M12P13 description. Note: The scaling of the source parameter is such that when it is at its maximum value, and M12P19 (VEL1 IN2 SCALE) = 1.000, the IN2 input to VAR SEL 1 is at 100 %.	R-W	Range: MXXPXX Default: M00P00 (00.00)
M12P15	**VAR SEL 1 MODE** Use to select the mode for the variable selector 1 as defined below: [0] SEL IN 1 Output = Input 1 [1] SEL IN 2 Output = Input 2 [2] ADD Output = Input 1 + Input 2 [3] SUBTRACT Output = Input 1 – Input 2 [4] MULTIPLY Output = (Input 1 x Input 2)/100.0 [5] DIVIDE Output = (Input 1 x 100.0)/Input 2 [6] FILTERED Output = Input 1/(M12P20 x S + 1) [7] RAMPED Output = Input 1 via ramp: M12P20 (sec) [8] ABS VALUE Output = |(Input 1)| in Mode [6] "S" in the equation is the Laplace identifier and M12P20 is the time constant for the 1st order filter. See M12P13 description.	R-W	Range: [0] to [8] Default: [0] SEL IN 1
M12P16	**VARSEL1 OUT DEST** Enter the destination for the output of the variable selector 1. Factory defaulted to an unused parameter M00P00. See M12P13 description. Note: The scaling to the destination parameter is such that when M12P17 (VAR SEL 1 OUTPUT) = 100.0 %, the destination parameter will be set to its maximum value.	R-W	Range: MXXPXX Default: M00P00 (00.00)
M12P17	**VAR SEL 1 OUTPUT** This parameter monitors the result of the variable selector 1. See M12P13 description.	R-O	Range: ±100.0% Default:
M12P18	**VSEL1 IN1 SCALE** Enter a value to scale the variable selector 1 input 1 parameter. See M12P13 description.	R-W	Range: ±10.000 Default: 1.000
M12P19	**VSEL1 IN2 SCALE** Enter a value to scale the variable selector 1 input 2 parameter. See M12P13 description.	R-W	Range: ±10.000 Default: 1.000
M12P20	**VAR SEL1 CONTROL** Enter a value for the variable selector 1 control parameter. This parameter serves as a filter time constant or a ramp time in sec depending on the mode defined by parameter M12P15 See M12P13 description.	R-W	Range: 0.00 to 100.00 sec Default: 0.00
M12P21	**VARSEL1 HI LIMIT** The maximum positive selector 1 output can be limited by this parameter. See M12P13 description.	R-W	Range: 0 to 100.0 % Default: 100.0

M12P22	**VARSEL1 LO LIMIT** The maximum negative or minimum positive selector 1 output can limited by this parameter. See M12P13 description.	R-W	Range: -100.0 to 100.0 % Default: -100.0
M12P23	**VAR SEL2 IN1 SRC** Enter the source for variable selector 2 input 1. See M12P13 description. Note: The scaling of the source parameter is such that when it is at its maximum value, and M12P28 (VEL2 IN1 SCALE) = 1.000, the IN1 input to VAR SEL 2 is at 100 %.	R-W	Range: MXXPXX Default: M00P00 (00.00)
M12P24	**VAR SEL2 IN2 SRC** Enter the source for variable selector 2 input 2. See M12P13 description. Note: The scaling of the source parameter is such that when it is at its maximum value, and M12P29 (VEL2 IN2 SCALE) = 1.000, the IN2 input to VAR SEL 2 is at 100 %.	R-W	Range: MXXPXX Default: M00P00 (00.00)
M12P25	**VAR SEL 2 MODE** Use to select the mode for the variable selector 2 as defined below: [0] SEL IN 1 Output = Input 1 [1] SEL IN 2 Output = Input 2 [2] ADD Output = Input 1 + Input 2 [3] SUBTRACT Output = Input 1 – Input 2 [4] MULTIPLY Output = (Input 1 x Input 2)/100.0 [5] DIVIDE Output = (Input 1 x 100.0)/Input 2 [6] FILTERED Output = Input 1/(M12P30 x S + 1) [7] RAMPED Output = Input 1 via ramp: M12P30 (sec) [8] ABS VALUE Output = |(Input 1)| in Mode [6] "S" in the equation is the Laplace identifier and M12P30 is the time constant for the 1st order filter. See M12P13 description.	R-W	Range: [0] to [8] Default: [0] SEL IN 1
M12P26	**VARSEL2 OUT DEST** Enter the destination for the output of the variable selector 2 See M12P13 description. Note: The scaling to the destination parameter is such that when M12P27 (VAR SEL 2 OUTPUT) = 100.0 %, the destination parameter will be set to its maximum value.	R-W	Range: MXXPXX Default: M00P00 (00.00)
M12P27	**VAR SEL 2 OUTPUT** This parameter monitors the result of the variable selector 2. See M12P13 description.	R-O	Range: ±100.0% Default:
M12P28	**VSEL2 IN1 SCALE** Enter a value to scale the variable selector 2 input 1 parameter. See M12P13 description.	R-W	Range: ±10.000 Default: 1.000
M12P29	**VSEL2 IN2 SCALE** Enter a value to scale the variable selector 2 input 2 parameter. See M12P13 description.	R-W	Range: ±10.000 Default: 1.000

M12P30	**VAR SEL2 CONTROL** Enter a value for the variable selector 2 control parameter. This parameter serves as a filter time constant or a ramp time in sec depending on the mode defined by parameter M12P25 See M12P13 description.	R-W	Range: 0.00 to 100.00 sec Default: 0.00
M12P31	**VARSEL2 HI LIMIT** The maximum positive selector 1 output can be limited by this parameter. See M12P13 description.	R-W	Range: 0 to 100.0 % Default: 100.0
M12P32	**VARSEL2 LO LIMIT** The maximum negative or minimum positive selector 2 output can limited by this parameter. See M12P13 description.	R-W	Range: -100.0 to 100.0 % Default: -100.0
M12B33	**MECH BRAKE SEQ** Closed & open loop parameter If set to 1, the drive will control bit parameter M12B34 (BRAKE RELEASE) such that if M12B34 is used as a source for one of the digital outputs connected one of the output relays, the solenoid of a mechanical brake can be properly sequenced to release and apply the brake.	R-W	Range: 0 or 1 Default: 0
M12B34	**BRAKE RELEASE** Closed & open loop parameter This parameter should be used as a source for one of the digital outputs connected to an output relay which can then in turn control the solenoid of a mechanical brake. If parameter M12B33 is set to 1, parameter M12B34 will be properly sequenced by the drive to release and apply the brake as the drive is started and stopped.	R-O	Range: 0 or 1 Default: 0
M12P35	**UPPER CURR LEVEL** Open loop parameter See Open loop description of parameter M12P36 below.	R-W	Range: 0 to 100.0 % Default: 50.0
M12P36	**LOWER CURR LEVEL** Closed & open loop parameter Open Loop: The value of parameter M04P01 (MOT CURR-TOTAL) is compared to the upper and lower current levels by a comparator with hysteresis to detect the presence of torque and loss of control of the motor respectively. The upper and lower level currents are given as a percentage of motor current as defined by parameter M05P06 (RATED MOTOR CURR) or parameter M17P05 (RATED MOTOR CURR) if 2nd motor parameters are selected. The upper current level should be set to the current level that indicates that there is magnetizing current and sufficient torque producing current in the motor to deliver the required amount of torque when the brake is released. The output of the comparator remains active after this level has been reached unless the current falls below the lower current level which should be set to the level that allows the drive to detect when the motor is no longer being controlled by the drive. Closed Loop: When the value of parameter M04P01 (MOT CURR-TOTAL) falls below the setting of this parameter, the mechanical brake is applied immediately. The setting of	R-W	Range: 0 to 100.0 % Default: 10.0

	this parameter should be such that it allows the drive to detect when the motor is no longer being controlled by the drive.		
M12P37	**BRAKE REL FREQ** Open loop parameter A frequency comparator is used to detect when the motor frequency has reached a level where the motor can produce the required amount of torque to ensure that the motor rotates in the demanded direction when the brake is released. The setting of this parameter should be slightly above the motor slip frequency that will occur when the highest expected load is applied to the motor.	R-W	Range: 0 to 20.0 Hz Default: 1.0
M12P38	**BRAKE APPLY SPD** Closed & open loop parameter Open Loop: The brake apply frequency threshold is used to ensure that the brake is applied before the motor frequency reaches zero and to prevent the motor rotating in the reverse direction during the brake apply time. If the frequency falls below this threshold, but motor is not required to stop (i.e. reversing direction without stopping), the brake will not be applied (as long as parameter M01B11 is set to 1. Closed Loop: When stopping, the drive reference can be off (M01B11 = 0), but the brake will remain energized (released) until the motor has remained at a speed below the brake apply speed for the time defined by parameter M12P40 (BRAKE APPLY SPD DLY). This delay prevents rapid application and release of the brake when fine speed control of the motor is required near zero speed.	R-W	Range: 0 to 20.0 Hz Default: 1.0
M12P39	**PREBRAKE REL DLY** Open loop parameter The pre-brake release delay allows time for the motor torque to buildup to the required level before the brake is released. This time allows the motor flux to reach rated value (3 times rotor time constant of the motor). During the pre-brake delay period, the motor frequency is held constant by holding the reference ramp (M02B36 = 1).	R-W	Range: 0 to 25.0 Sec Default: 1.0
M12P40	**BRAKE APLSPD DLY** Closed loop parameter See Closed Loop description of parameter M12P38 (BRAKE APPLY SPD).	R-W	Range: 0 to 25.0 Sec Default: 1.0
M12P41	**POSTBRAK REL DLY** Closed & open loop parameter Open Loop: The post-brake release delay allows for the brake release time. During this period, the motor frequency is held constant by holding the reference ramp (M02B36 = 1), so there is no sudden increase in motor speed when the brake actually releases. Closed Loop: post-brake release delay allows for the brake release time. From the time that the drive is enabled and then during this period, the speed reference is held constant at zero, so there is no sudden increase in motor speed when the brake actually releases.	R-W	Range: 0 to 25.0 Sec Default: 1.0
M12P42	**BRAKE APPLY DLY** Closed loop parameter The brake apply delay is used to allow for the brake	R-W	Range: 0 to 25.0 Sec Default: 1.0

	application time. During this period, the HOLD ZERO SPEED (M06B19) and RAMP HOLD (M02B36) parameters are set to 1 and so the drive is enabled with zero speed reference. This ensures that the motor remains stationary while the brake is being applied.		
M12P43	**BRAKE POS CONTRL** Closed loop parameter If this parameter is set to 0, then ramp hold only is applied when the drive is not active and until the end of the post-brake release delay to ensure that the speed reference remains at zero until the brake has released. If this parameter is set to 1 the position controller is also enabled (M15P07 = RIGD FFWD) and the local position reference source is selected (M15P01 = LOCAL REF, M15B21 = 1) during the period when ramp hold is active. Assuming parameter M15B08 (ABS POS ENABLE) is set to its default value of 0, the position controller can help limit the movement of the motor when the brake is released. When parameter M12P43 is changed from 1 to 0, parameter M15P01 is set to "DRIVE PG" and M15P07 is set to "DISAB POS". Only active if M12B44 (EN TORQ PROVING) = 0.	R-W	Range: 0 or 1 Default: 0
M12B44	**EN TORQ PROVING** Closed loop parameter If set to 1, the Closed loop mechanical brake sequence will build-up a positive torque in a direction to lift the load prior to setting M12B34 (BRAKE RELEASE) to 1 which releases the mechanical brake. If M12B44 is set to 0, the Closed loop mechanical brake sequence will hold zero speed or zero position while the mechanical brake is applied and for a time delay after it is released.	R-W	Range: 0 or 1 Default:
M12P45	**TORQ PROVING REF** Closed loop parameter Sets the Torque Proving level in percent of rated torque.	R-W	Range: 0 to $\frac{M11P35}{M05P06} \times 100\%$ Default: 20.0
M12P46	**TORQPROVING TOUT** Closed loop parameter The Torque Proving Time Out time is the allowed time for drive output torque to reach the level set by M12P45 before a "TORQ PROV" fault is generated.	R-W	Range: 0 to 100.0 Sec Default: 0.5
M12B47	**TORQPROOF STATUS** Closed loop parameter M12B47 = 1 indicates that the drive output torque has reached the torque proving level set by M12P45.	R-O	Range: 0 or 1 Default:
M12B48	**EN BRAKE ACKNLDG** Closed loop parameter If set to 1, the Closed loop mechanical brake sequence will look for a "feedback" signal from the mechanical brake to insure that it is either released or applied before continuing with sequencing. If M12B48 is set to 1, the Closed loop mechanical brake sequence will wait for M12B49 (BRAKE ACK FEEDBK) to be a 1 and then apply the POSTBRAK REL DLY (M12P41) to allow for the mechanical brake release time before continuing with sequencing. It will also wait for M12B49 (BRAKE ACK FEEDBK) to be a 0 and then apply the BRAKE APPLY DLY (M12P42) to allow for the brake apply time before continuing with the sequencing. If M12B48 is set to 0, the Closed loop mechanical brake sequence will just use the POSTBRAK REL DLY (M12P41)	R-W	Range: 0 or 1 Default:

	to allow for the mechanical brake release time and use the BRAKE APPLY DLY (M12P42) to allow for the brake apply time before continuing with the sequencing.		
M12B49	**BRAKE ACK FEEDBK** Closed loop parameter This parameter should be used as a destination for one of the digital inputs if parameter M12B48 (EN BRAKE ACKNLDG) is set to 1. An input contact to this digital input should represent release of the brake. When the brake is released, M12B49 should be a 1. The digital input can be inverted if necessary by use of the digital input invert parameters.	R-W	Range: 0 or 1 Default:
M12P50	**BRAKE APPLY TOUT** Closed loop parameter When M12B34 (BRAKE RELEASE) changes from 1 to 0, M12B49 (BRAKE ACK FEEDBK) must change from 1 to 0 within the Brake Apply Time Out time or a "BRAK APLY" alarm will be generated on the keypad display and M10B44 (BRAKE APLY ALARM) will be set to 1. The drive will continue to hold zero speed.	R-W	Range: 0 to 3276.0 Sec Default: 1.0
M12P51	**BRAKE REL TOUT** Closed loop parameter When M12B34 (BRAKE RELEASE) changes from 0 to 1, M12B49 (BRAKE ACK FEEDBK) must change from 0 to 1 within the Brake Release Time Out time or a "BRAKE REL" fault will be generated.	R-W	Range: 0 to 3276.0 Sec Default: 1.0
M12P52	**SLACKROPE TORQUE** Closed loop parameter Sets the minimum positive torque level (regenerative torque) when drive is running in reverse (lowering the load) and M12B53 (ENSLACKROPE DET) is set to 1.	R-W	Range: 0 to 100% Default: 20.0
M12B53	**EN SLACKROPE DET** Closed loop parameter If set to 1, and the drive is running in reverse (lowering the load) if the speed becomes too high, where the positive torque level (regenerative torque) drops below, M12P52, the drive will decrease the lowering speed to prevent a "slack rope" condition.	R-W	Range: 0 or 1 Default: 0
M12P54	**PROVNG TORQ RESP** Closed loop parameter This parameter sets the response of the Proving Torque.	R-W	Range: 0 to 1000 msec Default: 25
M13P01	**RUN-TIME LOG Y-D** Indicates years and days of the total running time of the drive.	R-O	Range: 0.000 to 9.364 y.ddd Default:
M13P02	**RUN-TIME LOG H-M** Indicates the hours and minutes of the total running time of the drive.	R-O	Range: 00.00 to 23.59 hh.mm Default:
M13P03	**ENERGY IN MWH** Indicates MWH of energy consumed.	R-O	Range: 0 to 10000 MWh Default:
M13P04	**ENERGY IN KWH** Indicates kWh of energy consumed.	R-O	Range: 000.0 to 1000.0 kWh Default:
M13P05	**RUNNING COST** Continuously indicates the running cost/hour. Requires the correct value to be entered in M13P08.	R-O	Range: 0 to XXXX M13P08/h Default:
M13P06	**COUNTDOWN TIMER1** Indicates the running time remaining until timer1 has counted down to zero.	R-O	Range: 0 to 10000 h Default:
M13P07	**COUNTDOWN TIMER2** Indicates the running time remaining until timer2 has counted down to zero.	R-O	Range: 0 to 10000 h Default:

M13P08	**COST PER KWH** Enter electricity cost for use by M13P05.	R-W	Range: 00.00 to 100.00 Currency Default: 0
M13B09	**RESET POWER MTR** Set at 1 to reset M13P03 and M13P04.	R-W	Range: 0 or 1 Default: 0
M13P10	**STARTTIME TIMER1** Enter the running time the drive must operate before timer1 counts down to zero.	R-W	Range: 0 to 10000 h Default: 0
M13B11	**TIMER1 DONE** M13B11 is automatically set at 1 when M13P06 = 0. Set M13B11 at 0 to reset countdown timer1. This causes M13P06 to be loaded with the value of M13P10.	R-W	Range: 0 or 1 Default: 0
M13P12	**STARTTIME TIMER2** Enter the running time the drive must operate before timer2 counts down to zero.	R-W	Range: 0 to 10000 h Default: 0
M13B13	**TIMER2 DONE** M13B13 is automatically set at 1 when M13P07 = 0. Set M13B13 at 0 to reset countdown timer2. This causes M13P07 to be loaded with the value of M13P12.	R-W	Range: 0 or 1 Default: 0
M13P14	**GEN AMPLITUDE** Use this parameter to set the amplitude of the square wave signal produced by the generator in percent.	R-W	Range: 0 to 200.0% Default: 0
M13P15	**GEN OFFSET** Use this parameter to set the offset of the square wave signal produced by the generator in percent.	R-W	Range: -200.0 to +200.0% Default: 0
M13P16	**GEN PULSEWIDTH 1** Use this parameter to set the pulse width of the square wave high-signal produced by the generator in msec.	R-W	Range: 0.1 to 3276 sec Default: 1
M13P17	**GEN PULSEWIDTH 2** Use this parameter to set the pulse width of the square wave low-signal produced by the generator in msec.	R-W	Range: 0.1 to 3276 sec Default: 1
M13P18	**GEN OUTPUT** This parameter monitors the generator output.	R-O	Range: MXXPXX Default:
M13P19	**GEN DESTINATION** Enter the parameter number to use as the destination for the generator output signal. Factory defaulted to an unused parameter. Note: The scaling to the destination parameter is such that when M13P18 (GEN OUTPUT) = 100.0 %, the destination parameter will be set to its maximum value.	R-W	Range: MXXPXX Default: M00P00 (00.00)
M14P01	**PID OUTPUT** The inputs to the PID controller are automatically scaled to the range ±100.0%. The PID controller output is also within this range. Although it would appear that the variables have only a 10-bit resolution, internal calculations are made at a higher resolution for greater accuracy. The displayed values are scaled versions of the internal variables. The output after the scale factor M14P15 is automatically scaled to match the range of the destination parameter. Gain parameters are actual units, as follows: PID output = Pe + Ie/s + Des	R-O	Range: ±100.0 % Default:

	Where: P, I and D are the programmed gains e is the input error to the PID controller s is the Laplace identifier With an error of 100%, if P = 1.000 the output produced by the proportional term is 100%. With an error of 100%, if I = 1.000 the output produced by the integral term will increase linearly by 100% every second. With an error that is increasing by 100% per second, if D = 1.000 the output produced by the D term will be 100%.		
M14P02	**MAIN REF SOURCE** See parameter M14P01. Factory defaulted to an unused parameter M00P00 which is equivalent to setting the source signal to 0. If a non-valid parameter is programmed the input value is taken as 0. All variable inputs to the PID are automatically scaled to variables having the range ±100.0%, or 0 - 100.0% if they are unipolar. Note: The scaling of the source parameter is such that when it is at its maximum value, the MAIN REFERENCE (M14P20) is at 100 %.	R-W	Range: MXXPXX Default: M00P00 (00.00)
M14P03	**PID REF SOURCE** See parameter M14P01. Factory defaulted to an unused parameter M00P00 which is equivalent to setting the source signal to 0. If a non-valid parameter is programmed the input value is taken as 0. All variable inputs to the PID are automatically scaled to variables having the range ±100.0%, or 0 - 100.0% if they are unipolar. Note: The scaling of the source parameter is such that when it is at its maximum value, the PID REFERENCE (M14P17) is at 100 %.	R-W	Range: MXXPXX Default: M00P00 (00.00)
M14P04	**PID FEEDBACK SRC** See parameter M14P01. Factory defaulted to an unused parameter M00P00 which is equivalent to setting the source signal to 0. If a non-valid parameter is programmed the input value is taken as 0. All variable inputs to the PID are automatically scaled to variables having the range ±100.0%, or 0 - 100.0% if they are unipolar. Note: The scaling of the source parameter is such that when it is at its maximum value, the PID FEEDBACK (M14P18) is at 100 %.	R-W	Range: MXXPXX Default: M00P00 (00.00)
M14B05	**INVERT REFERENCE** See parameter M14P01. This parameter is used to change the sense of the PID	R-W	Range: 0 or 1 Default: 0

	reference signal. Setting this parameter to a 1 causes the signal seen by the input to be inverted.		
M14B06	**INVERT FEEDBACK** See parameter M14P01. This parameter is used to change the sense of the PID feedback signal. Setting this parameter to a 1 causes the signal seen by the input to be inverted.	R-W	Range: 0 or 1 Default: 0
M14P07	**PID REF SLEWRATE** See parameter M14P01. This parameter defines the time taken for the reference input to ramp from 0 to 100.0% following a 0 to 100% step change in input. Changes from -100.0% to +100.0% will take twice this time.	R-W	Range: 0.1 to 3276 Sec Default: 0.1
M14B08	**PID ENABLE** See parameter M14P01. This parameter must be at 1 for the PID controller to operate, if it is 0 the PID output will be 0.	R-W	Range: 0 or 1 Default: 0
M14P09	**PID ENABLE SRC** See parameter M14P01. This parameter can be used to control when the PID function is enabled via a bit parameter. This bit parameter is ANDed with the PID enable parameter M14B08 to enable the PID function. If a non-valid parameter is programmed the input to the PID controller is taken as a 1. Any valid optional enable programmed must be a 1 for the PID controller to operate; if it is a 0 then the output will be 0. Factory defaulted to an unused parameter M00P00 which is equivalent to setting the source to 1.	R-W	Range: MXXPXX Default: M00P00 (00.00)
M14P10	**PROPORTIONAL GAIN** See parameter M14P01. This is the proportional gain applied to the PID error.	R-W	Range: 0 to 10.000 Default: 1.000
M14P11	**INTEGRAL GAIN** See parameter M14P01. This is the gain applied to the PID error before being integrated.	R-W	Range: 0 to 10.000 Default: 0.500
M14P12	**DERIVATIVE GAIN** See parameter M14P01. This is the gain applied to the PID error before being differentiated.	R-W	Range: 0 to 10.000 Default: 0
M14P13	**PID HIGH LIMIT** See parameter M14P01. The maximum positive PID output can be limited by this parameter.	R-W	Range: 0 to 100.0 % Default: 100.0
M14P14	**PID LOW LIMIT** See parameter M14P01. The maximum negative or minimum positive PID output can be limited by this parameter.	R-W	Range: −100.0 to +100.0 % Default: −100.0

M14P15	**PID OUT SCALING** See parameter M14P01. This parameter scales the final addition of the PID OUTPUT and the MAIN REFERENCE.	R-W	Range: 0.000 to ±10.000 Default: 1.000
M14P16	**PID OUT DESTINAT** See parameter M14P01. Factory defaulted to an unused parameter M00P00. This destination parameter defines the parameter to be controlled by the PID function. If a non-valid parameter is programmed the output is not routed anywhere. If the PID is to control speed then it is suggested that one of the preset speed parameters is entered here. If the PID is to trim speed then it is suggested that the offset parameter M01P15 is entered here. The output after the scale factor M14P15 is automatically scaled to match the range of the destination parameter. Note: The scaling to the destination parameter is such that when M14P01 (PID OUTPUT) = 100.0 %, and M14P15 (PID OUT SCALING) = 1.000, the destination parameter will be set to its maximum value.	R-W	Range: MXXPXX Default: M00P00 (00.00)
M14P17	**PID REFERENCE** This parameter monitors the PID controller reference.	R-O	Range: ±100.0% Default:
M14P18	**PID FEEDBACK** This parameter monitors the PID controller feedback.	R-O	Range: ±100.0% Default:
M14P19	**PID ERROR** This parameter monitors the PID controller error.	R-O	Range: ±100.0% Default:
M14P20	**MAIN REFERENCE** This parameter monitors the PID controller main reference.	R-O	Range: ±100.0% Default:
M15P01	**POS REF SOURCE** This parameter is used to select the position reference source. The reference can be taken from the drive encoder or an optional encoder or a local reference. If the reference and feedback sources are the same the position controller is disabled. [0] DRIVE PG Drive encoder [1] PG # 2 Optional encoder [2] LOCAL REF Local reference	R-W	Range: [0]-[2] Default: [0] DRIVE PG
M15P02	**POS FEEDBACK SRC** This parameter is used to select the position feedback source. The feedback can be taken from the drive encoder or an optional encoder. If the feedback and reference sources are the same the position controller is disabled. [0] DRIVE PG Drive encoder [1] PG # 2 Optional encoder	R-W	Range: [0]-[1] Default: [0] DRIVE PG
M15B03	**POS REF INVERT** This parameter can be used to invert the position reference.	R-W	Range: 0 or 1 Default: 0
M15P04	**RATIO NUMERATOR** An exact ratio can be applied to the position reference with a numerator and denominator parameters. Example: With M15P04 = 3000, and M15P05 = 1000, the	R-W	Range: 0 to 4000 Default: 1000

	ratio will be 3000/1000, or 3. With this ratio, for every revolution of the master drive, the follower drive will make three revolutions.		
M15P05	**RATIO DENOMINATR** See M15P04 for description.	R-W	Range: 1 to 1000 Default: 1000
M15P06	**POS LOOP GAIN** The gain of the position controller is controlled by this parameter.	R-W	Range: 0.00 to 100.00 rad/sec/rad Default: 5.00
M15P07	**POS CONTROL MODE** This parameter is used to set the position controller mode as described below: [0] DISAB POS Position controller disabled [1] RIGD FFWD Rigid control with feed forward [2] RIGID Rigid position control [3] NRIGDFFWD Non-rigid control with feed-forward [4] NON RIGID Non-rigid position control [5] ORIENT ST Orientation on stop [6] ORIENT SE Orientation on stop when drive is enabled Rigid Position Control: The position error is always accumulated in Rigid Position Control. If for example the slave shaft is slowed down due to an overload condition, the target position is recovered by running at higher speed when the overload condition is removed. Non-Rigid Position Control: In Non-Rigid Position control the position loop is only active when the "AT SPEED" condition is met. Slippage will occur while the error speed is high. Velocity Feed-Forward: The position controller can generate a velocity feed-forward value from the speed of the reference encoder. The feed-forward value is passed thru menu 1 so ramps may be included if required. Because the position controller only has a proportional gain, it is necessary to use velocity feed-forward to prevent a constant position error that would be proportional to the speed of the reference position. If for any reason the user wishes to provide the velocity feed forward from a source other than the reference position, the feed-forward system can be made inactive i.e. M15P07 = 2 or 4. The external feed-forward can be provided via Menu 1 from any of the frequency/speed references. However, if this feed-forward level is not correct a constant position error will exist. Orientation on Stop: The drive orientates the motor following a stop command. If HOLD ZERO SPEED is enabled (M06P19 = 1) the drive remains in position control when orientation is complete and holds the orientation position. If HOLD ZERO SPEED is not enabled the drive is disabled when orientation is complete. Orientation on stop and when drive is enabled: The drive orientates the motor following a stop command	R-W	Range: [0] - [6] Default: [0] DISAB POS

	and whenever the drive is enabled provided that hold zero speed is enabled (M06B19 = 1). This ensures that the spindle is always held in the same position following the drive being enabled. When orientating from a stop command the drive goes through the following sequence: - The motor is decelerated or accelerated to the speed limit programmed in M15P09, using ramps if these are enabled, in the direction the motor was previously running. - When the ramp output reaches the speed set in M15P09, ramps are disabled and the motor continues to rotate until the position is found to be close to the target position. At this point the speed demand is set to 0 and the position loop is closed. - When the position is within the window defined by M15P11, the orientation complete indication is given in M15P12. The STOP MODE selected by M06P01 has no effect if orientation is enabled NOTES: The position controller is disabled and the error integrator is also reset under the following conditions: - The drive is ready, disabled, or tripped. - The POSITION CONTROL MODE M15P07 is [0] "DISAB POS". - The reference or feedback position sources are invalid. - The POSITION CONTROL MODE M15P07 is changed. - The ABSOLUTE POSITION ENABLE M15P08 is changed. - The POSITION ERROR RESET M15P13 is set to one The position error is not accumulated under the following condition: - The position error is not being reset and the POSITION CONTROL MODE M15P07 is in "NRIGDFFWD" or "NON RIGID" and the drive is not at speed. The position loop is enabled under the following conditions: - The POSITION CONTROL MODE M15P07 is in "RIGID", "RIGD FFWD", orienting, and the drive is in RUN mode. - POSITION CONTROL MODE M15P07 is in "NRIGDFFWD" or "NON RIGID" and "AT SPEED".		
M15B08	**ABS POS ENABLE** When this parameter is set to 1 and the POSITION CONTROLLER MODE M15P07 is 1 or 2, the position error integrator is loaded with the absolute position error defined by the position sources when the position controller is disabled. Therefore when this parameter M15P08= 1 the position controller operates on the absolute position from the reference and feedback. If the feedback device is not absolute then the absolute position is the change of position since the drive was powered-up. When this parameter is zero or the position control mode is not 1 or 2 the error integrator is loaded with zero when the position controller is disabled. Therefore the position controller operates on the relative position changes of the	R-W	Range: 0 or 1 Default: 0

	reference and feedback from the point when the position controller is re-enabled. It should be noted that the value of this parameter does not affect the operation of the marker reset for any position source. If the drive MARKER RESET ENABLE M03P32 is 1, the position controller takes the position source including the effect of the marker. When a marker event occurs the position and turns are reset to zero. If the MARKER RESET ENABLE M03P32 =0 then the marker events have no effect on the position source used by the position controller.		
M15P09	**POS ERR SPD LMT** This parameter limits the velocity correction applied by the position controller. This value is also used as the reference during orientation.	R-W	Range: 0 to M01P06 Hz Default: 5.0 HZ
M15P10	**ORIENT POS REF** Use this parameter to enter a value for the orientation position reference. This parameter is in terms of fractions of a revolution of the feedback encoder, where 32768 =1 revolution.	R-W	Range: 0 to 32767 (1 turn) Default: 16383
M15P11	**ORIENT OK WINDOW** Use this parameter to enter a value for the orientation OK window. This parameter is in terms of fractions of a revolution of the feedback encoder, where 32768 =1 revolution.	R-W	Range: 0 to 4096 (1/8 turn) Default: 256
M15B12	**ORIENT COMPLETE** When the position is within the window defined by M12P11 indicates orientation is complete.	R-O	Range: 0 or 1 Default:
M15B13	**POS ERROR RESET** The position error integrator is preset to the absolute error when M15P07 = 1 or 2, and M15P08 =1; otherwise it is set to zero when M15B13 is set to one. The position controller is disabled and the error integrator is also reset under the following conditions: - The drive is ready, disabled or tripped. - The reference or feedback position sources are invalid. - The POSITION CONTROL MODE M15P07 is changed. - The ABSOLUTE POSITION ENABLE M15P08 is changed. - The POSITION ERROR RESET M15P13 is set to one.	R-W	Range: 0 or 1 Default: 0
M15P14	**RELATIVE JOG REF** This parameter can used for relative jog reference to move the feedback position relative to the reference position.	R-W	Range: 0 to 1000.0 Hz Default: 0
M15B15	**REL JOG ENABLE** Set at 1 to enable relative jog to move the feedback position relative to the reference position at a speed defined by M15P14.	R-W	Range: 0 or 1 Default: 0
M15B16	**RELATIVE JOG REV** Set at 1 to invert the relative jog reference.	R-W	Range: 0 or 1 Default: 0
M15P17	**LOCAL REF TURNS** The local reference can be used to control the position of the motor shaft. If the LOCAL REFERENCE ENABLE parameter M15B21 is 1 the previously written value is used. This allows the two parts of the local reference position to be changed without data skew problems.	R-W	Range: ±32767 Revolutions Default: 0

	This parameter is in terms of revolutions of the feedback encoder.		
M15P18	**LOCAL REF POSITN** See above description. Use this parameter to set the local reference in terms of fractions of a revolution of the feedback encoder, where 32768 = 1 revolution.	R-W	Range: ±32767 (±1 turn) Default: 0
M15P19	**PG2 REVOLUTIONS** This parameter indicates the position in terms of revolutions of the encoder #2 (optional encoder).	R-O	Range: ±32767 Revolutions Default:
M15P20	**PG2 POSITION** This parameter indicates the position in terms of fractions of a revolution of the encoder #2 (optional encoder), where 32768 =1 revolution.	R-O	Range: ±32767 (±1 turn) Default:
M15B21	**LOCAL REF ENABLE** See M15P17 description.	R-W	Range: 0 or 1 Default: 0
M15P22	**PG2 CONSTANT PPR** Use this parameter to set the pulse per revolution (ppr) of the encoder # 2 (optional encoder).	R-W	Range: 0 to 8192 ppr Default: 1024
M15P23	**PG2 NO OF PHASES** Select [0] if only A phase or B phase is used. Select [1] if A & B phases are used (quadrature). [0] ONE PHASE One phase A or B [1] TWO PHASE Two phase A & B (quadrature)	R-W	Range: [0] – [1] Default: [1] TWO PHASE
M15P24	**PG2 ROTATION SEL** This setting determines how the drive interprets the rotation of the encoder #2 (optional encoder). This parameter can be used to change the direction of the motor without having to change the encoder wiring. [0] CLOCKWISE Clockwise rotation [1] C-CLOCKWS Counterclockwise rotation	R-W	Range: [0] – [1] Default: [0] CLOCKWISE
M15P25	**REVOLUTIONS ERR** This parameter indicates the position error in terms of revolutions of the feedback encoder.	R-O	Range: ±32767 Revolutions Default:
M15P26	**POSITION ERROR** This parameter indicates the position error in terms of fractions of a revolution of the feedback encoder, where 32768 =1 revolution.	R-O	Range: ±32767 (±1 turn) Default:
M15B27	**PG2 MARKR RST EN** Use this parameter to enable the encoder marker channel to reset the encoder position and encoder revolutions, but only if M15B28 is initially = 0. An incremental digital encoder may have a marker channel. When this channel becomes active it may be used to reset the encoder position and revolutions and set the ENCODER #2 MARKER FLAG M15B27. When the position is reset by the marker, M15P19 and M15P20 are reset to zero. The marker flag is set when the marker input becomes active, but it is not reset by the drive, this must be done by the user.	R-W	Range: 0 or 1 Default: 0

M15B28	**PG2 MARKR FLAG** See M15P27 description.	R-W	Range: 0 or 1 Default: 0
M15P29	**PG2 SPEED** This parameter indicates the speed of encoder #2 (optional encoder).	R-O	Range: ± 32760 RPM
M17P01	**MINIMUM FREQ** Motor 2 parameter Use in unipolar mode to define the minimum output frequency of the drive. This can be over-ridden by M17P02 and is inactive during Jog. Corresponding Motor 1 parameter: M01P05	R-W	Range: 0 to M17P02 Hz Default: 0
M17P02	**MAX FREQUENCY** Motor 2 parameter Enter a value to define the absolute maximum output frequency. Corresponding Motor 1 parameter: M01P06	R-W	Range: 0 to 600.0 Hz Default: 60.0
M17P03	**ACCEL RAMP 1** Motor 2 parameter Acceleration ramp rate is expressed as the time for the output frequency to increase by 100Hz. For example, a programmed ramp time of 5 seconds causes the frequency to increase or decrease by 50Hz in 2.5 seconds. Corresponding Motor 1 parameter: M02P03	R-W	Range: 0.1 to 3276 s/100Hz Default: Size 0: 30.0 sec Size 1: 30.0 sec Size 2: 60.0 sec Size 3: 60.0 sec
M17P04	**DECEL RAMP 1** Motor 2 parameter Deceleration ramp rate is expressed as the time for the output frequency to decrease by 100Hz. Corresponding Motor 1 parameter: M02P04	R-W	Range: 0.1 to 3276 s/100Hz Default: Size 0: 30.0 sec Size 1: 30.0 sec Size 2: 60.0 sec Size 3: 60.0 sec
M17P05	**RATED MOTOR CURR** Motor 2 parameter When parameter M17P05 is set at a value lower than the default rating of the drive, the maximum current of the drive can be greater than 1.5 times the motor rating. Consequently, the maximum value of current limit and torque parameters (M17P15, M17P16, M04P06, M17P17 and M06P04) can be increased proportionately. For example, if a 180 Amp drive has parameter M17P05 set at 90 Amps, the maximum values of parameters M17P15, M17P16, M17P17 and M06P04 can be 300% (2 x 150%). This allows larger drives to be used for a high starting torque. When the value is increased beyond the default value of M17P05, the values of M17P15, M17P16 and M17P17 are automatically decreased. The value entered affects the following: Slip compensation Dynamic V/f Ixt detection level Industrial and HVAC applications Industrial applications benefit from a higher percentage of	R-W	Range: 0-1800 A Default: Model Dependent

	overload current, but have a lower nominal current. HVAC applications benefit from a higher nominal current, but have a lower percentage of overload current (120%). The overload current has the same value in each case. See parameter M05P18. Corresponding Motor 1 parameter: M05P06		
M17P06	**RATED MOTOR RPM** Motor 2 parameter The rated full load rpm is used with the motor rated frequency to calculate the rated slip of induction motors in Hz. $\text{RatedSlip} = \text{M17P08} - \frac{\text{M17P09} \times \text{M17P06}}{120}$ M17P06 is Rated Motor RPM M17P08 is Base Motor Frequency M17P09 is Number of Poles <u>Open loop:</u> If SLIP COMP ENABLE (M05B38) is set to 0 slip compensation is disabled. If slip compensation is required, M17P06 should be set to the nameplate value and M05B38 should be set at 1. Slip compensation is normally used to prevent droop in the motor shaft speed as load is applied. <u>Closed Loop:</u> Motor full load rpm is used with motor rated frequency to determine the full load slip of the motor necessary for closed loop vector control. Corresponding Motor 1 parameter: M05P07	R-W	Range: 0 to 32760 RPM Default: Model Dependent
M17P07	**RATED MOTOR VOLT** Motor 2 parameter Enter the value from the motor rating plate in order to define the maximum output voltage of the drive. Corresponding Motor 1 parameter: M05P08	R-W	Range: 100 to 600 VRMS Default: 240 480 575
M17P08	**BASE MOTOR FREQ** Motor 2 parameter Enter a value of frequency at which the rated voltage is to be applied to the motor. The motor then enters the constant-power or field-weakening region. Corresponding Motor 1 parameter: M05P09	R-W	Range: 10.0 to 600 Hz Default: 60.0
M17P09	**NUMBER OF POLES** Motor 2 parameter Enter the value from the motor rating plate for correct slip compensation and RPM indication. Corresponding Motor 1 parameter: M05P10	R-W	Range: [0] (2 POLES) to [15] (32 POLES) Default: [1] (4 POLES)
M17P10	**TORQUE I FACTOR** Motor 2 parameter Torque current which produces rated torque in the motor in percent of RATED MOTOR CURRENT M17P05. Corresponding Motor 1 parameter: M05P13	R-W	Range: 0 to 100.0% Default: Model dependent
M17P11	**FLUX CURR FACTOR** Closed loop parameter Motor 2 parameter Magnetizing current which produces rated flux in the motor	R-W	Range: 0 to 100.0% Default: Model dependent

	in percent of RATED MOTOR CURRENT M17P05. Corresponding Motor 1 parameter: M05P15		
M17P12	**SPEEDLOOP P GAIN** Closed loop parameter Motor 2 parameter Speed loop regulator proportional gain See Parameter M03P16 Corresponding Motor 1 parameter: M03P17	R-W	Range: 0 to 10000 Default: 150
M17P13	**SPEEDLOOP I GAIN** Closed loop parameter Motor 2 parameter Speed loop regulator integral gain See Parameter M03P16 Corresponding Motor 1 parameter: M03P18	R-W	Range: 0 to 10000 Default: 375
M17P14	**SPEEDLOOP D GAIN** Closed Loop Parameter Motor 2 parameter Speed loop regulator differential gain. See parameter M03P16. Corresponding Motor 1 parameter: M03P19	R-W	Range: 0 to 1000.0% Default: 0
M17P15	**MOTOR CURR LIMIT** Motor 2 parameter Normal current limit See parameter M17P05. Corresponding Motor 1 parameter: M04P04	R-W	Range: 0 to $\frac{\text{M11P35}}{\text{M17P05}}$ % Default: Max Number
M17P16	**REGEN CURR LIMIT** Motor 2 parameter Normal current limit. See parameter M17P05. Corresponding Motor 1 parameter: M04P05	R-W	Range: 0 to $\frac{\text{M11P35}}{\text{M17P05}}$ x100 % Default: Max Number
M17P17	**SYM CURRENT LIM** Motor 2 parameter After having set the required value of maximum current in M17P05, you may increase or decrease the percentage overload current using M17P17. The maximum percentage that can be set is limited by the overload current rating of the drive. The limit applies when motoring and regenerating. The value of M17P17 is automatically reduced when the value of M17P05 is increased beyond the default value. Corresponding Motor 1 parameter: M04P11	R-W	Range: See M17P15 % Default: 120 or 150 minimum
M17P22	**ROTOR TIME CONST** Closed loop parameter Motor 2 parameter Motor rotor time constant. Corresponding Motor 1 parameter: M04P23	R-W	Range: 0 to 10000 msec Default: Model dependent

List of parameters that cannot be used as destination for other parameters:
All read-only (R-O) parameters are of course included but not shown in the list below.

M00P01 TO M00P20

M01P04 KEYPAD REFERENCE
M01P06 MAX FREQUENCY
M02P33 ACEL RECOVR RAMP

M03P01 PG CONSTANT
M03P02 PG NO OF PHASES
M03P03 PG ROTATION SEL
M03P05 MOTOR GEAR TEETH
M03P06 LOAD GEAR TEETH
M03P20 ZERO SPEED THSLD
M03P24 SPEED FBK FILTER
M03P29 PGLOSS DEVIATION

M04P16 TORQ TIME CONST
M04P23 ROTOR TIME CONST

M05P06 RATED MOTOR CURR
M05P07 RATED MOTOR RPM
M05P08 RATED MOTOR VOLT
M05P09 BASE MOTOR FREQ
M05P10 NUMBER OF POLES
M05P11 AUTOBOOST VOLT
M05P13 TORQUE I FACTOR
M05P14 FIXED BOOST VOLT
M05P15 FLUX CURR FACTOR
M05P20 MAX PWM CARRIER
M05P21 MIN PWM CARRIER
M05P22 SPEED@MAX CARRIER
M05P23 SPEED@MIN CARRIER
M05P33 RATED LINE VOLTS

M06P02 AUTO-START MODE
M06P06 DB CHOPPER MODE
M06B12 KEYPAD START
M06B13 KEYPAD STOP
M06B14 KEYPAD FWD/REV
M06P31 MOP DESTINATION
M06P38 MIN SEARCH FREQ

M07P06 ANALOG OUT MODE
M07P07 ANALOG OUT 1 SCR

M07P08 ANALOG OUT 2 SRC
M07P09 ANALOG OUT 3 SRC
M07P10 ANALOG IN 1 MODE
M07P12 ANALOG IN 1 DEST
M07P13 ANALOG IN 2 MODE
M07P15 ANALOG IN 2 DEST
M07P16 ANALOG IN 3 MODE
M07P18 ANALOG IN 3 DEST
M08P09 F2 INPUT DESTINA
M08P11 F3 INPUT DESTINA
M08P13 F4 INPUT DESTINA
M08P15 F5 INPUT DESTINA
M08P17 F6 INPUT DESTINA
M08P19 F7 INPUT DESTINA
M08P21 F8 INPUT DESTINA
M08P23 MODE SELECT SRC
M08P24 MODESEL OUT DEST

M09P08 BIT SEL1 SOURCE1
M09P10 BIT SEL1 SOURCE2
M09P14 BIT SEL2 SOURCE1
M09P16 BIT SEL2 SOURCE2
M09P20 DIGITAL OUT3 SRC
M09P22 DIGITAL OUT4 SRC
M09P24 DIGITAL OUT5 SRC
M09P26 DIGITAL OUT6 SRC
M09P28 DIGITAL OUT7 SRC
M09P30 DIGITAL OUT1 SRC
M09P32 DIGITAL OUT2 SRC
M09P35 BITSEL1 OUT DEST
M09P37 BITSEL2 OUT DEST

M10B25 ENABLE AUTORESET
M10P27 NO OF AR ATTEMPS
M10P30 SERIAL TRIP

M11P01 DEFINE M00P01
M11P02 DEFINE M00P02
M11P03 DEFINE M00P03
M11P04 DEFINE M00P04
M11P05 DEFINE M00P05
M11P06 DEFINE M00P06
M11P07 DEFINE M00P07
M11P08 DEFINE M00P08
M11P09 DEFINE M00P09
M11P10 DEFINE M00P10
M11P11 DEFINE M00P11

M11P12 DEFINE M00P12
M11P13 DEFINE M00P13
M11P14 DEFINE M00P14
M11P15 DEFINE M00P15
M11P16 DEFINE M00P16
M11P17 DEFINE M00P17
M11P18 DEFINE M00P18

M11P19 DEFINE M00P19
M11P20 DEFINE M00P20
M11P23 SERIAL ADDRESS
M11P24 SERIAL PARITY
M11P25 BAUD RATE
M11P26 SERIAL PROTOCOL
M11P29 SECURITY CODE
M11P30 DISPLAY WHEN PWR
M11P33 DRIVE MODEL NO
M11P36 FACTORY DEFAULTS
M11P37 ACCESS CODE
M11P38 DRIVE TYPE
M11P44 ENABL SERIAL R/W

M12P03 THRESHOLD 1 SRC
M12P07 THRESHOLD1 DEST
M12P08 THRESHOLD2 SRC
M12P12 THRESHOLD2 DEST
M12P13 VAR SEL1 IN1 SRC
M12P14 VAR SEL1 IN2 SRC
M12P16 VARSEL1 OUT DEST
M12P23 VAR SEL2 IN1 SRC
M12P24 VAR SEL2 IN2 SRC
M12P26 VARSEL2 OUT DEST
M12P52 SLACKROPE TORQUE
M12P54 PROVING TORQ RESP

M13P08 COST PER KWH
M13P19 GEN DESTINATION

M14P02 MAIN REF SOURCE
M14P03 PID REF SOURCE
M14P04 PID FEEDBACK SRC
M14P09 PID ENABLE SRC
M14P16 PID OUT DESTINAT

M15P01 POS REF SOURCE
M15P02 POS FEEDBACK SRC
M15P22 PG2 CONSTANT PPR
M15P23 PG2 NO OF PHASES
M15P24 PG2 ROTATION SEL

M17P02 MAX FREQUENCY
M17P05 RATED MOTOR CURR
M17P06 RATED MOTOR RPM
M17P07 RATED MOTOR VOLT
M17P08 BASE MOTOR FREQ
M17P09 NUMBER OF POLES
M17P10 TORQUE I FACTOR
M17P11 FLUX CURR FACTOR
M17P22 ROTOR TIME CON

FAULT DESCRIPTION	
FAULT NUMBER-DISPLAY	***DESCRIPTION***
[1] ***CUR LOSS1****: Loss of current loop 1*	When parameter M07P10 is set at 3 or 4, this trip occurs when analog speed reference 1 current input (4-20mA or 20-4mA) is less than 3.0mA.
[2] ***EXT FAULT****: External Fault*	A fault signal has been detected, an input contact opened at TB2 terminal 6. Refer to parameter M08P13 and M10B29.
[3] ***MTR OVRLD****: Motor overload*	Actual motor current has exceeded the value defined by the speed sensitive overload "Continuous Operation Zone" for an excessive period of time (see Figure 10-3a.). See parameter M10B07 for full details.
[4] ***OVERTEMP****: Heatsink over-temperature*	The drive heatsink has reached its upper working temperature. Inadequate cooling.
[5] ***OVERCURR****: Instantaneous AC over-current trip*	Excessive current in the output of the drive, possibly indicating an external short-circuit at the output of the drive. **This would include short-circuits in the motor cables, connections in the motor conduit box or the motor itself.** This fault can also occur due to excessive "AUTO BOOST VOLT" (M05P11) or "FIXED BOOST VOLT" (M05P14) settings.
[6] ***OVERVOLT****: Bus over-voltage*	Over-voltage of the AC supply, or motor regeneration, causing the DC bus to exceed the maximum level. **If an over-voltage only occurs right after a run command, check for a short to ground at the output of the drive.** This would include short-circuits in the motor cables, connections in the motor conduit box or the motor itself.
[7] ***INPUTLOSS****: Input Loss*	Excessive AC line voltage unbalance or phase loss detected. Refer to parameter M06B20
[8] ***CNTRL PWR****: Control power fail*	Control Power supply dropped below normal. Consult the supplier of the drive.
[9] ***MOTORLOSS****: Motor Loss*	Motor current not detected or motor current below what it should be when the drive is in the RUN state. MOTORLOSS could also be caused by excessive "AUTO BOOST VOLT" (M05P11) or "FIXED BOOST VOLT" (M05P14) settings.
[10] Reserved	
[11] ***GATE FLT****: Gate drive fault*	IGBT driver power supply loss, power board hardware fault. Consult the supplier of the drive.
[12] ***PRECH AUX****: Precharge aux fail*	DC bus precharge contactor opened when it is supposed to be closed. Consult the supplier of the drive .
[13] ***UNDERVOLT****: Under voltage*	The DC bus voltage dropped below the minimum level.
[14] ***DRV OVRLD:*** *Drive Overload*	Actual current has exceeded the drive capacity. This could be caused by excessive "AUTO BOOST VOLT" (M05P11) or "FIXED BOOST VOLT" (M05P14) settings.
[15] ***KEYPDLOSS:****Keypad Loss*	No communication detected between the Control Keypad and the drive for a time period equal to parameter M06P48 (KEYPAD TIMEOUT).
[16] ***CUR LOSS2****: Loss of current loop 2*	When parameter M07P13 is set at 3 or 4, this trip occurs when analog speed reference 2 current input (4-20 mA or 20-4 mA) is less than 3.0mA.
[17] ***CUR LOSS3****: Loss of current loop 3*	When parameter M07P16 is set at 3 or 4, this trip occurs when analog speed reference 3 current input (4-20 mA or 20-4 mA) is less than 3.0mA.

[18] ***EEPROM**: Eeprom fault*	Control board hardware fault. Consult the supplier of the drive.
[19] ***SERIALOSS:** Serial Loss*	Communication from the master is lost by the slave (drive) for a time period equal to parameter M11P42 (SERIAL TIMEOUT). Note that a serial loss can only occur after communication has been established between the master and the drive (slave). The drive waits for the master to initiate communication.
[20] ***PRECHTIME:** Precharge contactor timeout*	DC bus precharge contactor failed to close on AC power-up.
[21] ***BUSRIPPLE**: Bus Ripple*	Excessive bus voltage ripple detected. This fault can be caused due to severe AC line voltage unbalance or phase loss or defective DC bus capacitors.
[22] ***OVERSPEED**: Overspeed*	Indicates that the drive speed has exceeded the overspeed threshold.
[23] Reserved	
[24] ***PG LOSS***	Indicates loss of PG.
[25] ***M1 OVRVLT:** Over-voltage power module no. 1*	Over-voltage power module no. 1 Over-voltage of the AC supply, or motor regeneration, causing the DC bus to exceed the maximum level. **If an over-voltage only occurs right after a run command, check for a short to ground at the output of the drive.** This would include short-circuits in the motor cables, connections in the motor conduit box or the motor itself.
[26] ***M2 OVRVLT:** Over-voltage power module no. 2*	Over-voltage power module no. 2 Over-voltage of the AC supply, or motor regeneration, causing the DC bus to exceed the maximum level. **If an over-voltage only occurs right after a run command, check for a short to ground at the output of the drive.** This would include short-circuits in the motor cables, connections in the motor conduit box or the motor itself.
[27] ***M3 OVRVLT:** Over-voltage power module no. 3*	Over-voltage power module no. 3 Over-voltage of the AC supply, or motor regeneration, causing the DC bus to exceed the maximum level. **If an over-voltage only occurs right after a run command, check for a short to ground at the output of the drive.** This would include short-circuits in the motor cables, connections in the motor conduit box or the motor itself.
[28] ***M4 OVERVLT:** Over-voltage power module no. 4*	Over-voltage power module no. 4 Over-voltage of the AC supply, or motor regeneration, causing the DC bus to exceed the maximum level. **If an over-voltage only occurs right after a run command, check for a short to ground at the output of the drive.** This would include short-circuits in the motor cables, connections in the motor conduit box or the motor itself.
[29] ***M5 OVRVLT:** Over-voltage power module no. 5*	Over-voltage power module no. 5 Over-voltage of the AC supply, or motor regeneration, causing the DC bus to exceed the maximum level. **If an over-voltage only occurs right after a run command, check for a short to ground at the output of the drive.** This would include short-circuits in the motor cables, connections in the motor conduit box or the motor itself.

[30] ***M6 OVRVLT:*** *Over-voltage power module no. 6*	Over-voltage power module no. 6 Over-voltage of the AC supply, or motor regeneration, causing the DC bus to exceed the maximum level. **If an over-voltage only occurs right after a run command, check for a short to ground at the output of the drive.** This would include short-circuits in the motor cables, connections in the motor conduit box or the motor itself.
[31] ***M1 OVRCUR:*** *Excessive current in power module no. 1*	Excessive current in power module no. 1 Excessive current in the output of the drive, possibly indicating an external short-circuit. **This would include short-circuits in the motor cables, connections in the motor conduit box or the motor itself.**
[32] ***M2 OVRCUR:*** *Excessive current in power module no. 2*	Excessive current in power module no. 2 Excessive current in the output of the drive, possibly indicating an external short-circuit. **This would include short-circuits in the motor cables, connections in the motor conduit box or the motor itself.**
[33] ***M3 OVRCUR:*** *Excessive current in power module no. 3*	Excessive current in power module no. 3 Excessive current in the output of the drive, possibly indicating an external short-circuit. **This would include short-circuits in the motor cables, connections in the motor conduit box or the motor itself.**
[34] ***M4 OVRCUR:*** *Excessive current in power module no. 4*	Excessive current in power module no. 4 Excessive current in the output of the drive, possibly indicating an external short-circuit. **This would include short-circuits in the motor cables, connections in the motor conduit box or the motor itself.**
[35] ***M5 OVRCUR:*** *Excessive current in power module no. 5*	Excessive current in power module no. 5 Excessive current in the output of the drive, possibly indicating an external short-circuit. **This would include short-circuits in the motor cables, connections in the motor conduit box or the motor itself.**
[36] ***M6 OVRCUR:*** *Excessive current in power module no. 6*	Excessive current in power module no. 6 Excessive current in the output of the drive, possibly indicating an external short-circuit. **This would include short-circuits in the motor cables, connections in the motor conduit box or the motor itself.**
[37] Reserved	
[38] Reserved	
[39] Reserved	
[40] Reserved	
[41] Reserved	
[42] Reserved	
[43] ***M1 IGBTFT:*** *IGBT fault power module no. 1*	IGBT fault power module no. 1 Fault detected in the power switching device

[44] ***M2 IGBTFT:*** *IGBT fault power module no. 2*	IGBT fault power module no. 2 Fault detected in the power switching device
[45] ***M3 IGBTFT:*** *IGBT fault power module no. 3*	IGBT fault power module no. 3 Fault detected in the power switching device
[46] ***M4 IGBTFT:*** *IGBT fault power module no. 4*	IGBT fault power module no. 4 Fault detected in the power switching device
[47] ***M5 IGBTFT:*** *IGBT fault power module no. 5*	IGBT fault power module no. 5 Fault detected in the power switching device
[48] ***M6 IGBTFT:*** *IGBT fault power module no. 6*	IGBT fault power module no. 6 Fault detected in the power switching device
[49] ***M1 GTFLT:*** *Gate fault power module no. 1*	Gate fault power module no. 1 Fault detected in the switch mode power supply for the IGBT gate driver
[50] ***M2 GTFLT:*** *Gate fault power module no. 2*	Gate fault power module no. 2 Fault detected in the switch mode power supply for the IGBT gate driver
[51] ***M3 GTFLT:*** *Gate fault power module no. 3*	Gate fault power module no. 3 Fault detected in the switch mode power supply for the IGBT gate driver
[52] ***M4 GTFLT:*** *Gate fault power module no. 4*	Gate fault power module no. 4 Fault detected in the switch mode power supply for the IGBT gate driver
[53] ***M5 GTFLT:*** *Gate fault power module no. 5*	Gate fault power module no. 5 Fault detected in the switch mode power supply for the IGBT gate driver
[54] ***M6 GTFLT:*** *Gate fault power module no. 6*	Gate fault power module no. 6 Fault detected in the switch mode power supply for the IGBT gate driver
[55] ***M1 OVRTMP:*** *Overtemp fault inverter power mod no. 1*	Overtemp fault inverter power module no. 1 The drive heatsink has reached its upper working temperature. Inadequate cooling.
[56] ***M2 OVRTMP:*** *Overtemp fault inverter power mod no. 2*	Overtemp fault inverter power module no. 2 The drive heatsink has reached its upper working temperature. Inadequate cooling.
[57] ***M3 OVRTMP:*** *Overtemp fault inverter power mod no. 3*	Overtemp fault inverter power module no. 3 The drive heatsink has reached its upper working temperature. Inadequate cooling.
[58] ***M4 OVRTMP:*** *Overtemp fault inverter power mod no. 4*	Overtemp fault inverter power module no. 4 The drive heatsink has reached its upper working temperature. Inadequate cooling.
[59] ***M5 OVRTMP:*** *Overtemp fault inverter power mod no. 5*	Overtemp fault inverter power module no. 5 The drive heatsink has reached its upper working temperature. Inadequate cooling.
[60] ***M6 OVRTMP:*** *Overtemp fault inverter power mod no. 6*	Overtemp fault inverter power module no. 6 The drive heatsink has reached its upper working temperature. Inadequate cooling.
[61] ***M1 NUIS:*** *Nuisance fault from power module no. 1*	Nuisance fault from power module no. 1 Fault detected in module 1 but type not recognized

[62] ***M2 NUIS:*** *Nuisance fault from power module no. 2*	Nuisance fault from power module no. 2 Fault detected in module 2 but type not recognized
[63] ***M3 NUIS:*** *Nuisance fault from power module no. 3*	Nuisance fault from power module no. 3 Fault detected in module 3 but type not recognized
[64] ***M4 NUIS:*** *Nuisance fault from power module no. 4*	Nuisance fault from power module no. 4 Fault detected in module 4 but type not recognized
[65] ***M5 NUIS:*** *Nuisance fault from power module no. 5*	Nuisance fault from power module no. 5 Fault detected in module 5 but type not recognized
[66] ***M6 NUIS:*** *Nuisance fault from power module no. 6*	Nuisance fault from power module no. 6 Fault detected in module 6 but type not recognized
[67] ***PM NUIS:*** *Nuisance fault from unknown module*	Fault detected from unknown module number but type not recognized
[68] ***SER TRIP1:*** *Serial Trip 1*	Drive fault caused by writing fault code 68 into M10P30 (SERIAL TRIP)
[69] ***SER TRIP2:*** *Serial Trip 2*	Drive fault caused by writing fault code 69 into M10P30 (SERIAL TRIP)
[70] Reserved	
[71] ***TORQ PROV:*** *Torque Proving fault*	The Proving Torque did not reach the level set by M12P45 (TORQ PROVING REF) within the time set by M12P46 (TORQPROVING TOUT)
[72] ***BRAKE REL:***	If M12B48 (EN BRAKE ACKNLDG) is set to 1, the Brake Acknowledge Feedback signal (M12B49) was not set to 1 within the Brake Release Time out time (M12P51)
[73] ***# OF MODS****: Number of Modules fault*	Drive fault for a drive model with parallel power modules. The number of power modules detected (M10P52) does not agree with the number of power modules required (M11P46). See parameters M10P52 (MODULES DETECTED) and M11P46 (MODULES REQUIRED) for more details. There are a number of causes for the "# OF MODS" fault to be generated: • If more than one module has multiple addresses selected. • If more than one module has the same address • If one or more modules do not have an address selected. • If ribbon cables between the modules are not connected or are defective. • If logic power is lost to one or more of the modules (e.g. power board (P/N: 3000-4060-X) failure) • Failure of a parallel module board (P/N: 3000-4075-X)Failure of the parallel driver board (P/N: 3000-4065-X) on the master module. • Failure of the master control board (P/N: 3000-4100-X)

COMMON OPTIONS AND INTERCONNECTS

WARNING: To avoid a hazard of electric shock, after the input and control power is removed from the drive and the ROM display is no longer lit, wait five (5) minutes for DC bus capacitors to fully discharge before opening the drive. Verify that the voltage on the DC bus capacitors has discharged by measuring the DC bus voltage at the +DC & -DC terminals of the drive. The voltage must be zero.

CAUTION: This drive contains ESD (Electrostatic Discharge) sensitive parts and assemblies. Static control precautions are required when installing, testing, servicing or repairing this assembly. Component damage may result if ESD control procedures are not followed.

Standard Drive with Manual Bypass Setup & Diagram 1 of 2

All standard drives with Manual Bypass are wired per this setup (same HOA described in 3.7.8) and no programming is needed.

Hand Mode:
Start command: Keypad RUN key.
Stop command: Keypad STOP key.
*FWD/REV command: Keypad USER key.
Jog command: JOG contact at TB2-3-TB2-1.
Reset command: keypad STOP/RESET key or pushbutton at TB2-7-TB2-1.
Speed reference source: Keypad reference M01P04.

Auto Mode:
Start/Stop command: Customer supplied AUTO Run contact.
*FWD/REV command: Contact at TB2-4-TB2-1.
Jog command: JOG contact at TB2-3-TB2-1.
Reset command: keypad STOP/RESET key or pushbutton at TB2-7-TB2-1.
Speed reference source:
- When TB2-8 is wired to TB2-1, analog reference 2 is selected for AUTO reference, 4-20MA operation with min speed when loss of 4-20MA signal (refer to M07P13 description for other choices).
- When TB2-8 is not wired to TB2-1, analog reference 1 is selected for AUTO reference, 0-10Vdc operation.

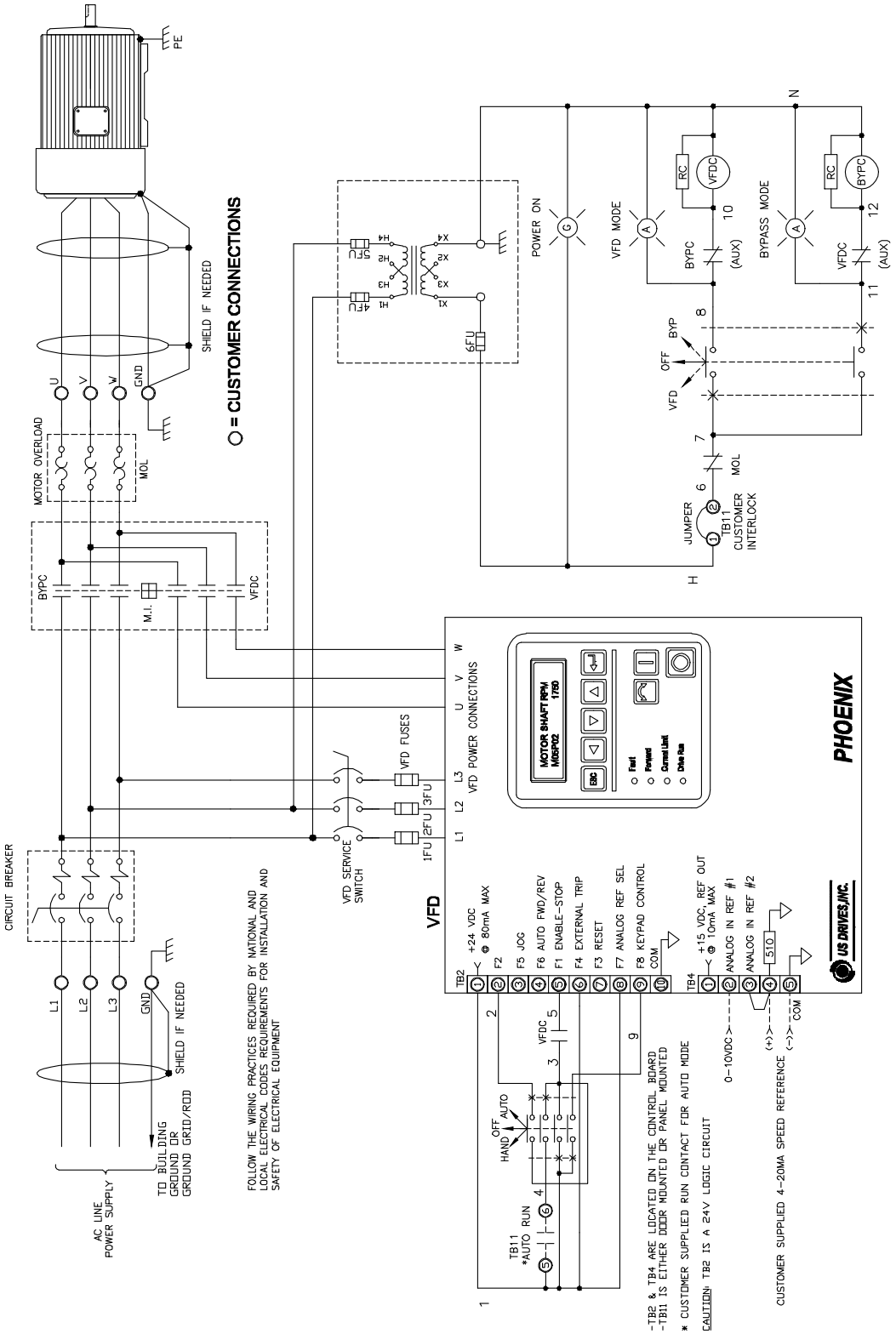
*Note: Reverse function is disabled. IF FWD/REV is needed set M06P23 (DISABLE REV ROT) to 0 and M06P18 (KEYPAD CONT MODE) to "ALL KEYS".

WARNING:
In the following steps, rotation of the motor in an undesired direction can occur. To guard against possible equipment damage, it is recommended that the motor be disconnected from the load before proceeding.

VFD Motor Rotation Check:
Sections 3.6.5 and 3.6.6 should first be performed with the "VFD-OFF-BYP" switch is in the "VFD" position and the "HAND-OFF-AUTO" switch in the "HAND" position. Follow all instructions using the Keypad frequency reference. If motor rotation is incorrect, as stated in section 3.6.5 interchange any two of the three customer "OUTPUT TO MOTOR" leads, U, V, or W. Under no circumstances should the internal drive wiring be interchanged. This completes the check for motor rotation in VFD mode.

Bypass Motor Rotation Check:
After stopping the VFD by pressing the ROM stop key, place the "HAND-OFF-AUTO" switch in the "OFF" position. Start the motor in BYPASS mode by placing the "VFD-OFF-BYP" switch in the "BYP" position. If the motor direction is incorrect, remove and lock-out input and control power to the drive. When the ROM is no longer illuminated, wait for five (5) minutes for the bus capacitors to fully discharge. Open the drive door and interchange any two of the three customer AC LINE INPUT leads, L1, L2, or L3. Under no circumstances should the internal drive wiring be interchanged. This completes the check for motor rotation in BYPASS mode.

Standard Drive with Manual Bypass Setup & Diagram 2 of 2



APPENDIX A-4

PROCESS SIGNAL FOLLOWER BOARD P/N: 3000-4040 & 3000-4040-120

INPUTS:

FOR INPUT VOLTAGE (DC) USE: TB1: TERMINAL # 1 (+) , TERMINAL # 3 (-) **Max input voltage: per table below**
FOR INPUT CURRENT USE: TB1: TERMINAL # 2 (+) , TERMINAL # 3 (-) **Max input current: 75mA**

OUTPUT:

OUTPUT VOLTAGE REFERENCE:	TB2: TERMINAL # 3	**0-10Vdc at 4 mA max**
OUTPUT CURRENT REFERENCE:	TB2: TERMINAL # 4	**4-20mA at 500W max**
COMMON, RETURN:	TB2: TERMINAL # 2	

SUPPLY VOLTAGE:

FOR BOARD P/N 3000-4040-120: TB3 TERMINAL#1 (HOT), TERMINAL#2 (NEUTRAL): 120VAC 50/60HZ 100MA MAX

FOR BOARD P/N 3000-4040: TB2 TERMINAL#1 (+), TERMINAL#2 (-): 24VDC 100MA MAX

JUMPER PROGRAMMING:

POSITION	MAX INPUT VOLTAGE	
12V	12V	
24V	24V	CONTACT FACTORY
48V	48V	CONTACT FACTORY
96V	96V	CONTACT FACTORY
192V	192V	CONTACT FACTORY

JP2 PROGRAMMING	
POSITION	INPUT
V-IN	VOLTAGE
I-IN	4-20 Ma @ 250$_{\Omega}$

POTENTIOMETERS:

Bias pot, used to set output to zero volts or 4mA at either zero volts input or 4mA current input.

- Voltage input: with input voltage set to zero volts, adjust POT1 BIAS for zero voltage at VOLT OUT.
- Voltage input: with input voltage set to zero volts, adjust POT1 BIAS for 4 mA at CURR OUT.

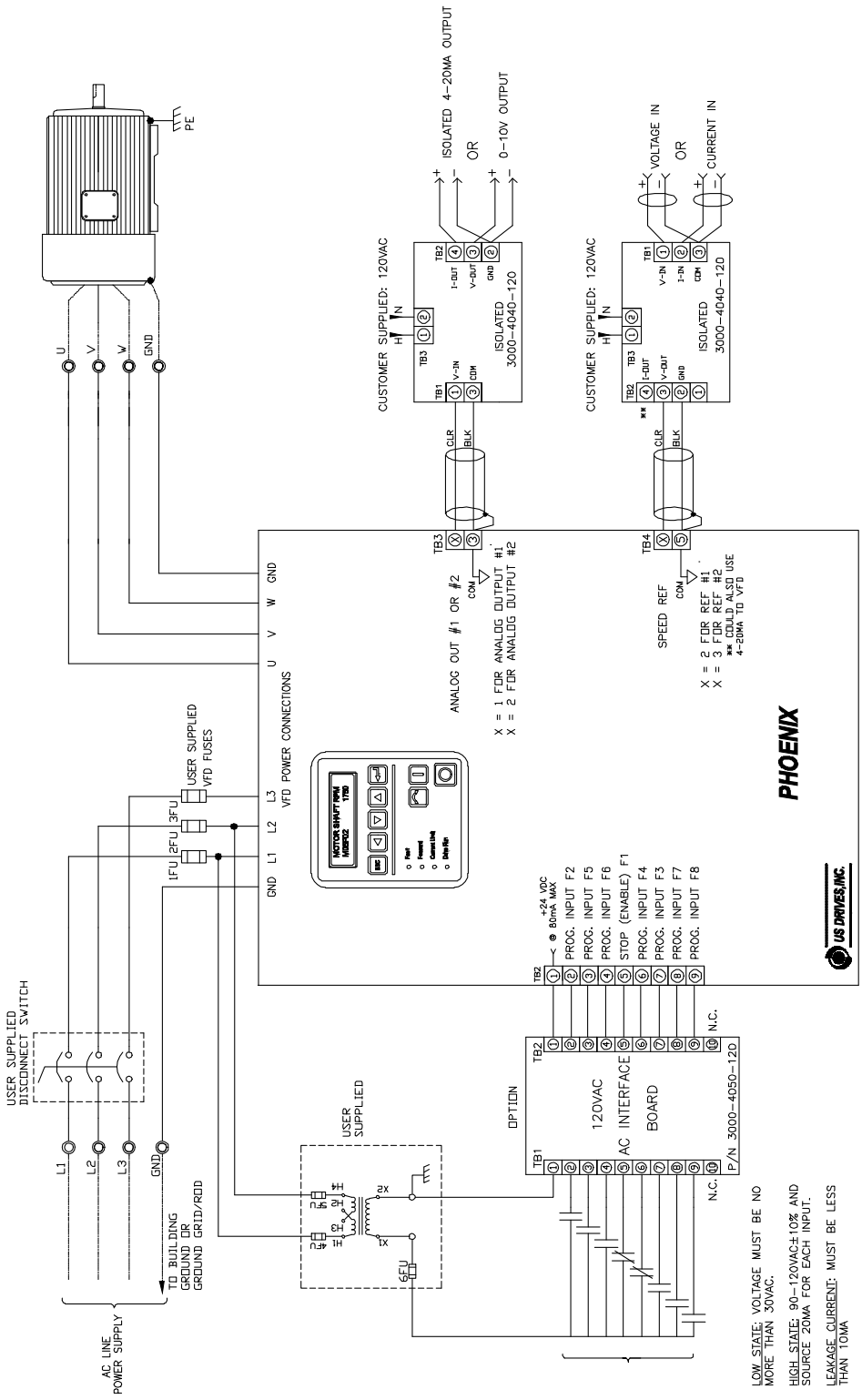
- Current input: current set to 4mA, adjust POT1 BIAS for zero voltage at VOLT OUT.
- Current input: current set to 4mA, adjust POT1 BIAS for 4 mA at CURR OUT.

Gain Pot, used to set output to 10Vdc or 20mA at maximum input voltage or 20mA input current.

- Voltage input: with input voltage set to maximum volts, adjust POT2 GAIN for 10Vdc at VOLT OUT.
- Voltage input: with input voltage set to maximum volts, adjust POT2 POT2 GAIN for 20mA at CURR OUT.

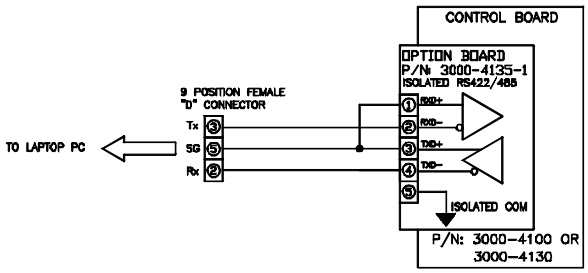
- Current input: current set to 20mA, adjust POT2 GAIN for 10Vdc at VOLT OUT.
- Current input: current set to 20mA, adjust POT2 GAIN for 20mA at CURR OUT.

Interconnect for Option Boards: 3000-4040-120 & 3000-4050-120

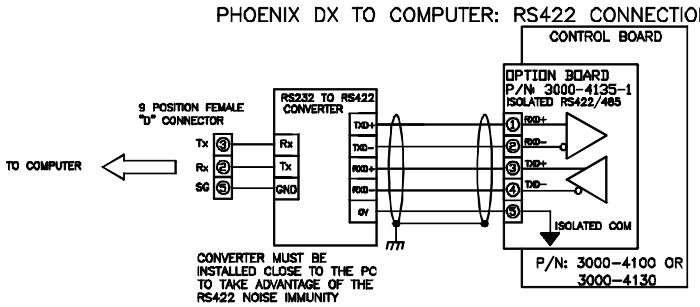


Isolated Communication Card P/N: 3000-4135 with Jumper on Position 1 (1 of 3)

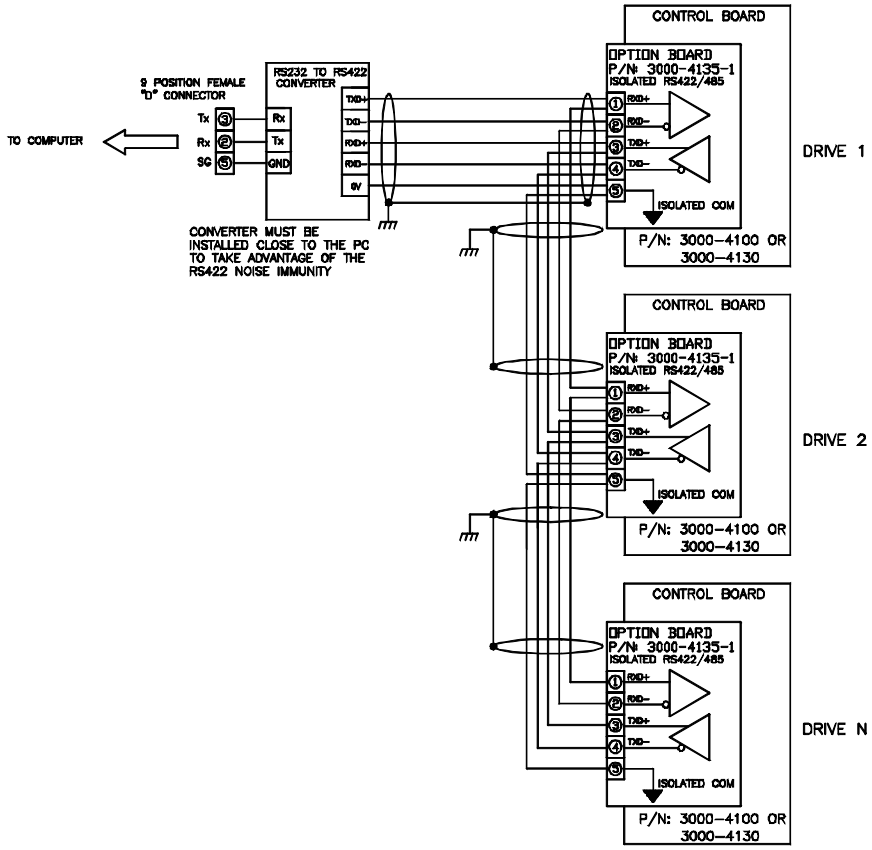
PHOENIX DX TO LAPTOP PC RS232 CONNECTION



PHOENIX DX TO COMPUTER: RS422 CONNECTION

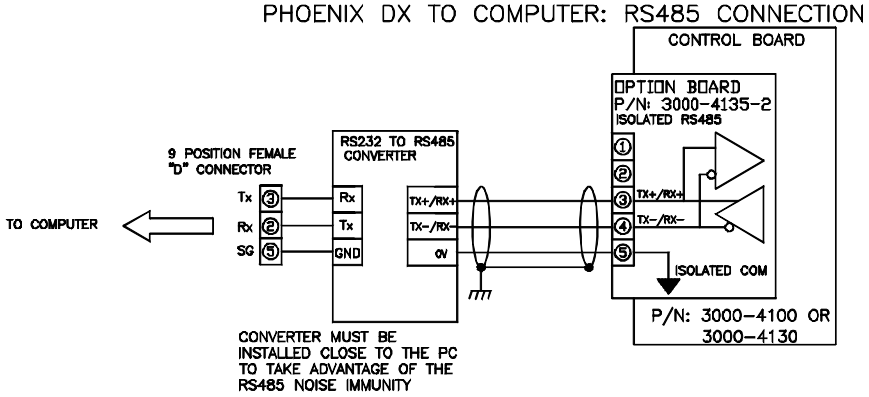


PHOENIX DX TO COMPUTER: RS485 4-WIRE PARTY-LINE CONNECTION

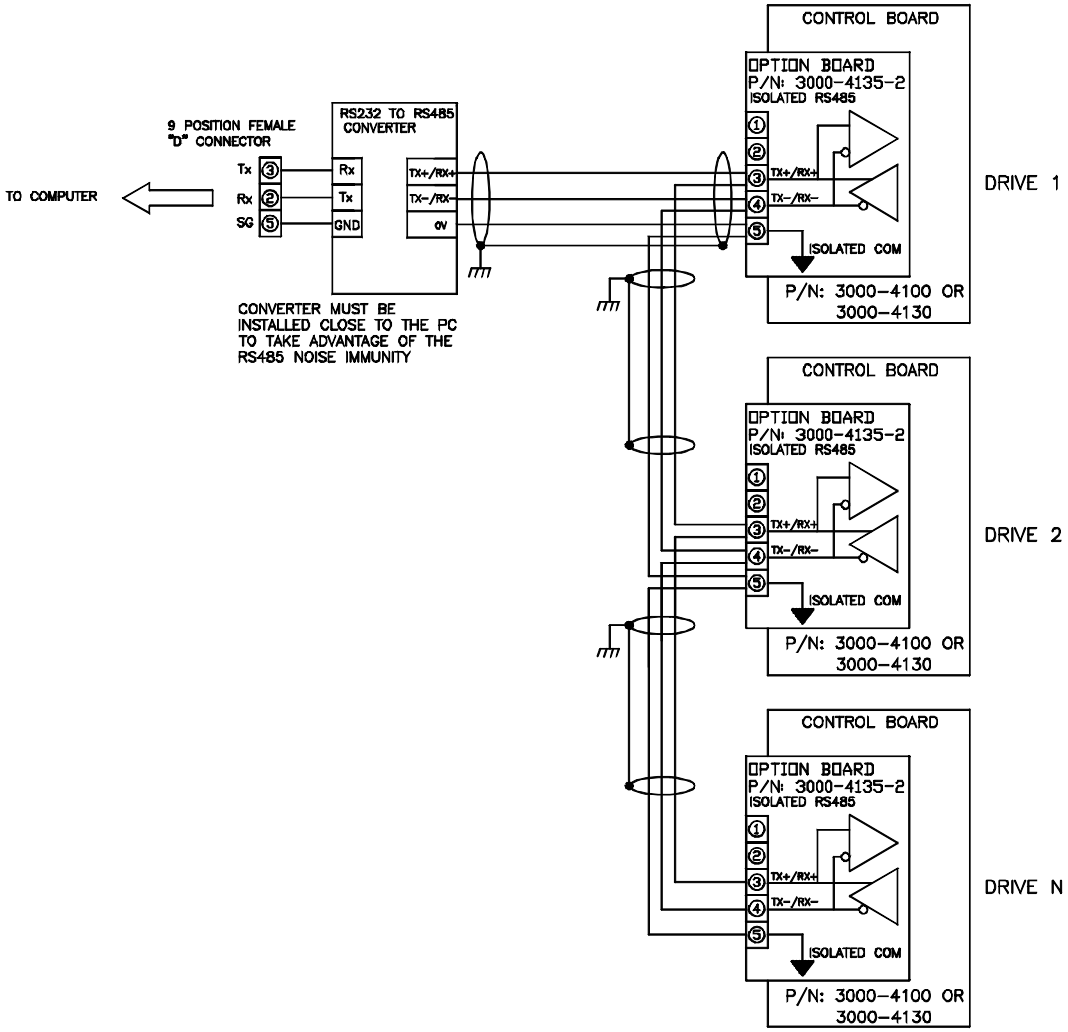


Isolated Communication Card P/N: 3000-4135 with Jumper on Position 2 (2 of 3)

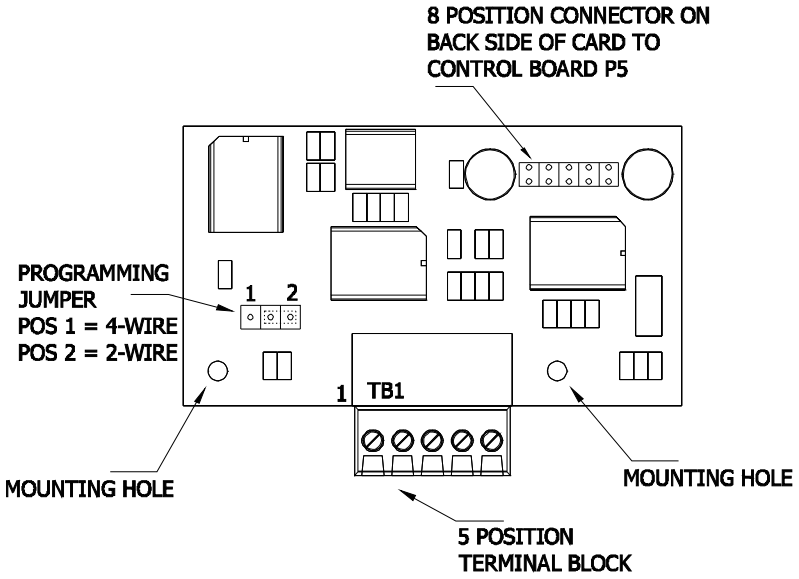
PHOENIX DX TO COMPUTER: RS485 CONNECTION



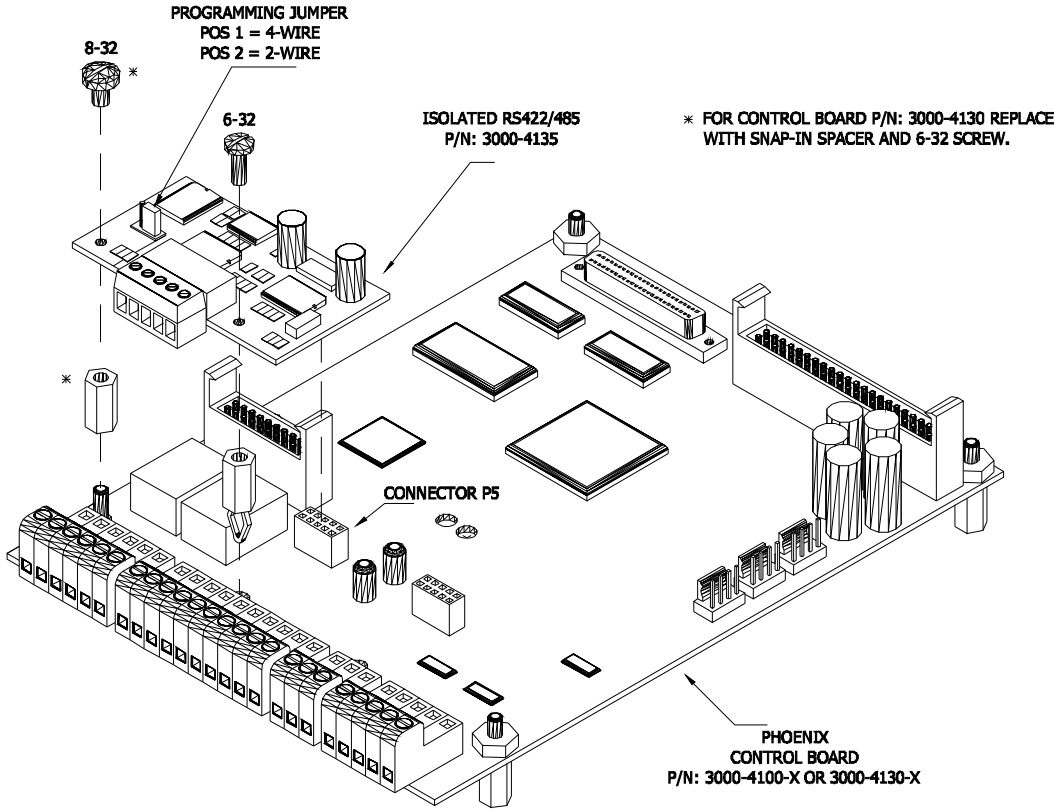
PHOENIX DX TO COMPUTER: RS485 2-WIRE PARTY-LINE CONNECTION



Isolated Communication Card P/N: 3000-4135 (3 of 3)

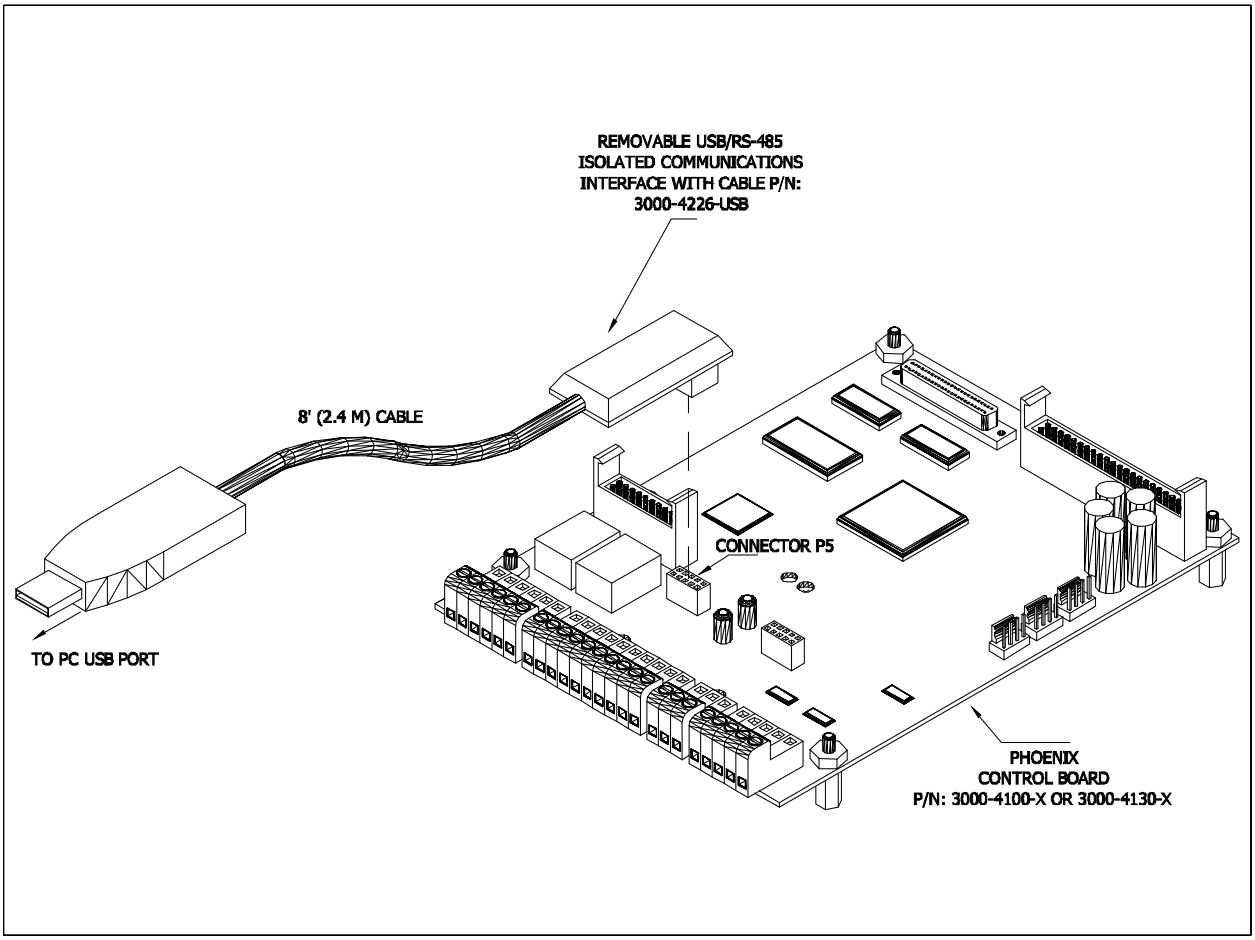


TB1 CONNECTION DATA:
MAXIMUM TORQUE: 2.2 Lb-in [0.25 N-m]
WIRE SIZE: 26-16 AWG [0.14 - 1 mm]



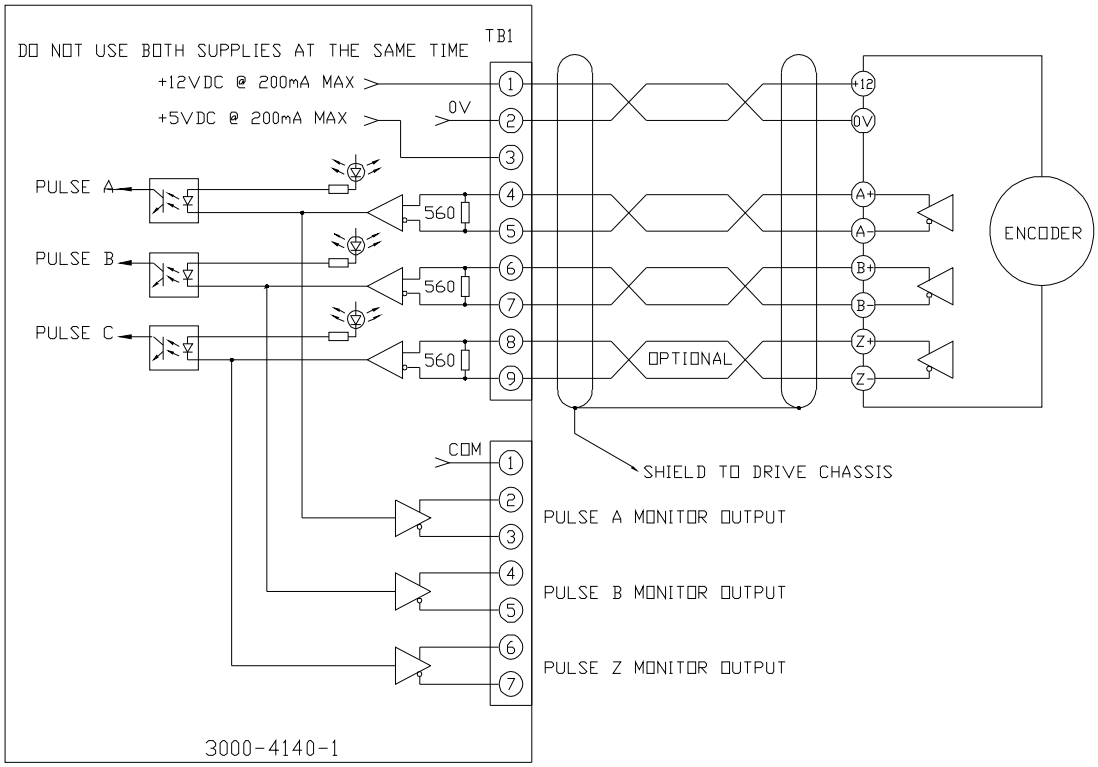
Mounting Diagram

Removable USB/RS-485 Isolated Communications Interface with Cable
P/N: 3000-4226-USB



Mounting Diagram

Digital Encoder Card P/N: 3000-4140-1 (1 of 3)



Terminal Block	No.	Signal	
TB1	1	+12VDC	Isolated Power Supply 12VDC, 200mA Max
	2	0VDC	Isolated Power Supply Common 0VDC
	3	+5VDC	Isolated Power Supply 5VDC, 200mA Max
	4	A+	A Phase Differential Input: 5 to 12VDC Max @ 20mA Max
	5	A-	Maximum Input Frequency = 300Khz
	6	B+	B Phase Differential Input: 5 to 12VDC Max @ 20mA Max
	7	B-	Maximum Input Frequency = 300Khz
	8	Z+	Z Phase Differential Input (optional): 5 to 12VDC Max @ 20mA Max
	9	Z-	Maximum Input Frequency = 300Khz
TB2	1	COM	0V reference for A, B, & Z outputs
	2	A+	A Phase Differential Output: 5VDC Max @ 20mA max
	3	A-	
	4	B+	B Phase Differential Output: 5VDC Max @ 20mA max
	5	B-	
	6	Z+	Z Phase Differential Output: 5VDC Max @ 20mA max
	7	Z-	

Digital Encoder Card P/N: 3000-4140-1 (2 of 3)

Notes:

- 5VDC and 12VDC cannot be used at the same time. External supply must be supplied to the encoder if the supply current exceeds 200mA

- Do not use the encoder power supply for anything else other than the encoder.

- Encoder must be differential-line-driver quadrature type 5-12VDC outputs, capable of supplying 20mA per channel

- Maximum input frequency is 300Khz. Use the following equation to check the encoder maximum frequency:

  $$F_{encoder\text{-}Max}(Hz) = \frac{MotorSpeed}{60} * EncoderPPR$$

  Where MotorSpeed = Maximum operating speed of the motor in RPM.
  EncoderPPR = Encoder resolution in PPR

  Example: Maximum operating motor speed = 3600 rpm
  Encoder resolution = 1024 PPR

  $$F_{encoder\text{-}Max}(Hz) = \frac{3600 \cdot RPM}{60} * 1024 \cdot PPR = 61.44Khz$$

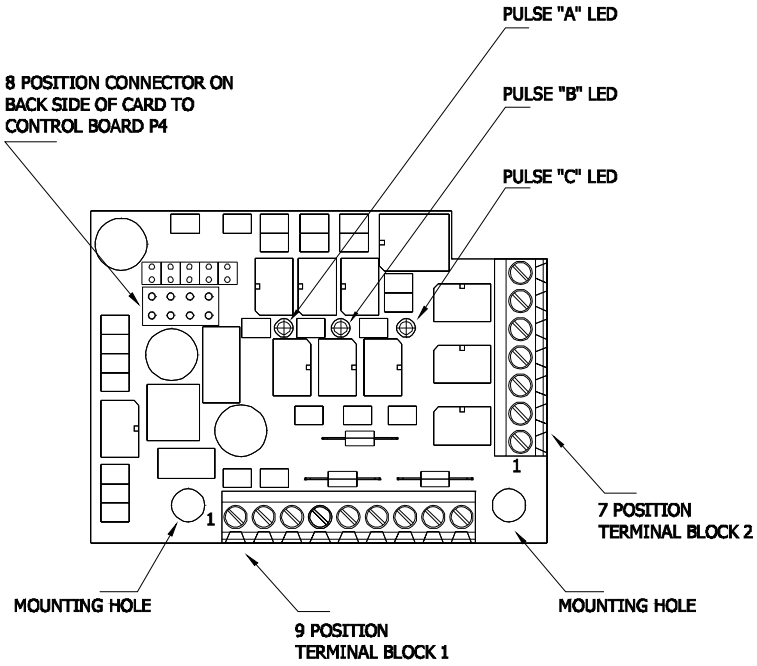
- The encoder cable must be kept from power cables. To prevent erroneous operation caused by noise interference, use shielded cable for control signal and limit distance to 100 meters (330 feet) or less.

- The encoder cable should be made of shielded twisted pair. Twist the shield wires together and connect it through the shortest possible route to the nearest ground terminal at the drive.

- The recommended wire for encoder input/outputs is: cable with pairs individually shielded:
  - Belden 9773 or equivalent - 18 AWG with three pairs individually shielded.
  - Belden 9873 or equivalent - 20 AWGwith three pairs individually shielded.
  - Belden 8777 or equivalent - 22 AWG with three pairs individually shielded.

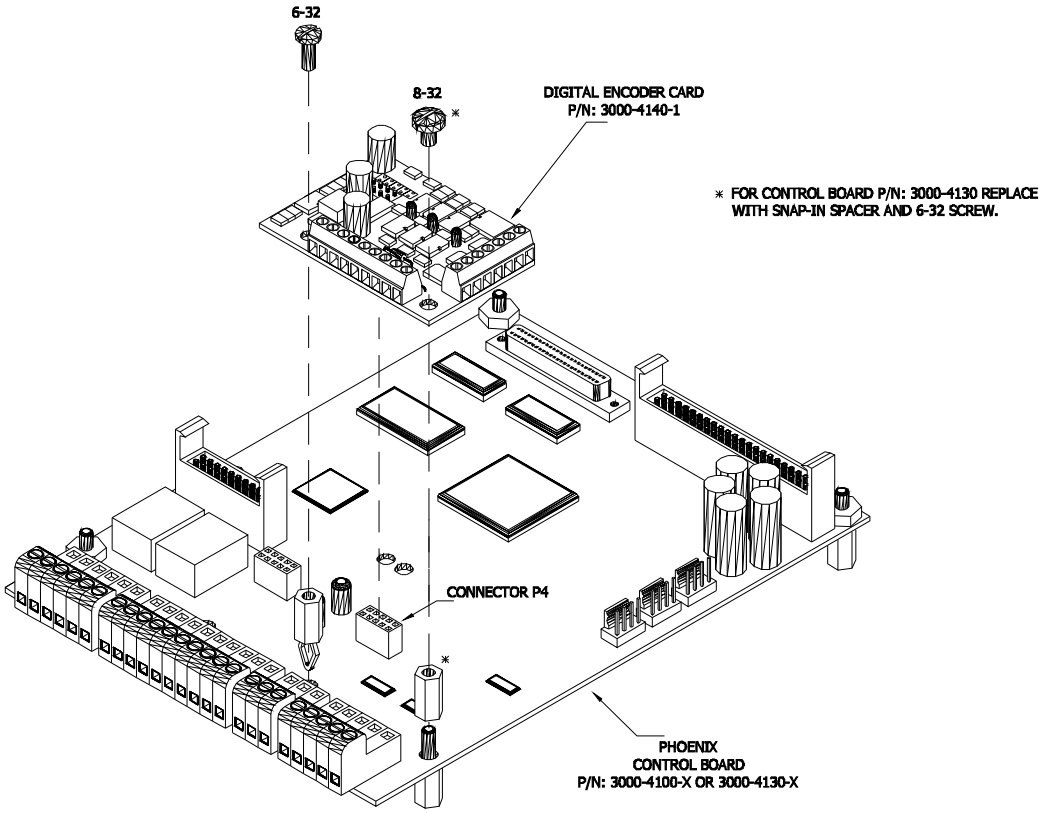
- The encoder should be insulated electrically from stator or rotor to prevent forming of current path through the encoder. The usual coupling-type encoder must have an electrically insulating coupling. When a hollow-shaft type pulse encoder is used, the insulation can be implemented by insulating the ball joints of the engaging arm, or by insulating the bar of the engaging arm. Shield of the encoder cable should be insulated from the encoder frame.

Digital Encoder Card P/N: 3000-4140-1 (3 of 3)



TB1-TB2 CONNECTION DATA:

MAXIMUM TORQUE: 2.2 Lb-in [0.25 N-m]
WIRE SIZE: 26-16 AWG [0.14 - 1 mm]



Mounting Diagram

I/O Expansion Board 3000-4150 (1 of 2)

Phoenix DX and Phoenix EX AC Drives include 8 Digital Inputs, 2 Digital Outputs, 2 Analog Inputs, and 2 Analog Outputs as standard. If additional Inputs and Outputs are required, the Phoenix DX/EX I/O Expansion Board may be added. With the addition of the Phoenix DX/EX I/O Expansion Board, the drive can support up to 8 Digital Inputs, 7 Digital Outputs, 3 Analog Inputs, and 3 Analog Outputs.

The Phoenix DX/EX I/O Expansion Board is fully configurable. You may add up to 5 Digital Outputs, 1 Analog Input, and 1 Analog Output. Catalog Numbering is as follows:

Part Numbering:

3000-4150 - AI - AO - D5

Analog Input

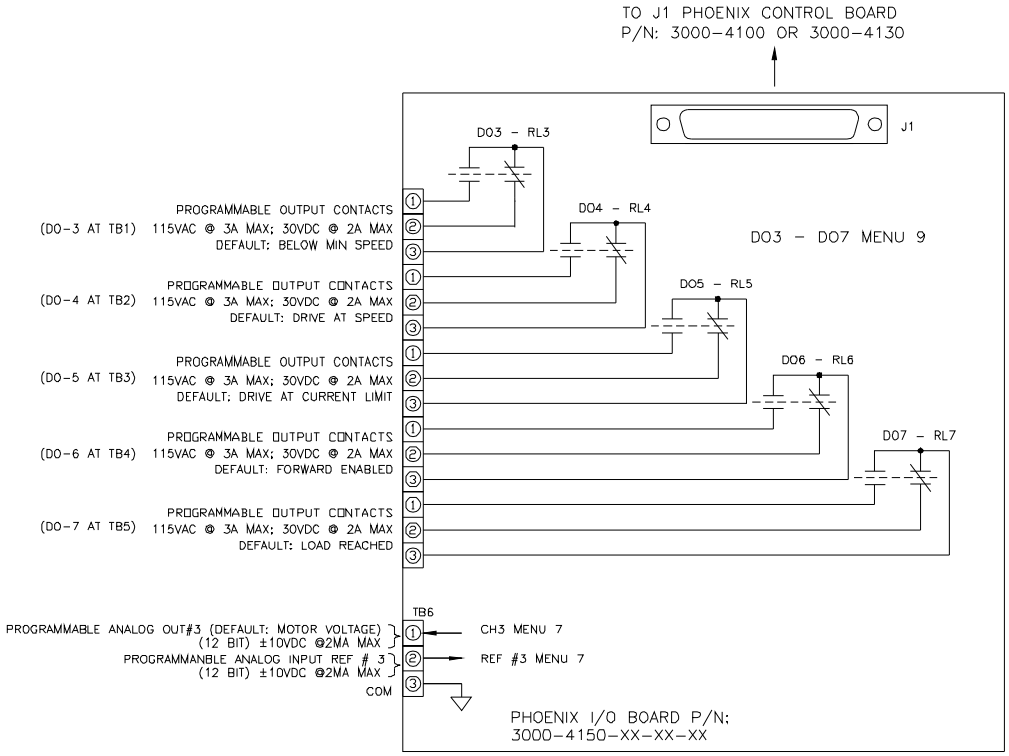
AI = Installed
= Not Installed

Analog Output

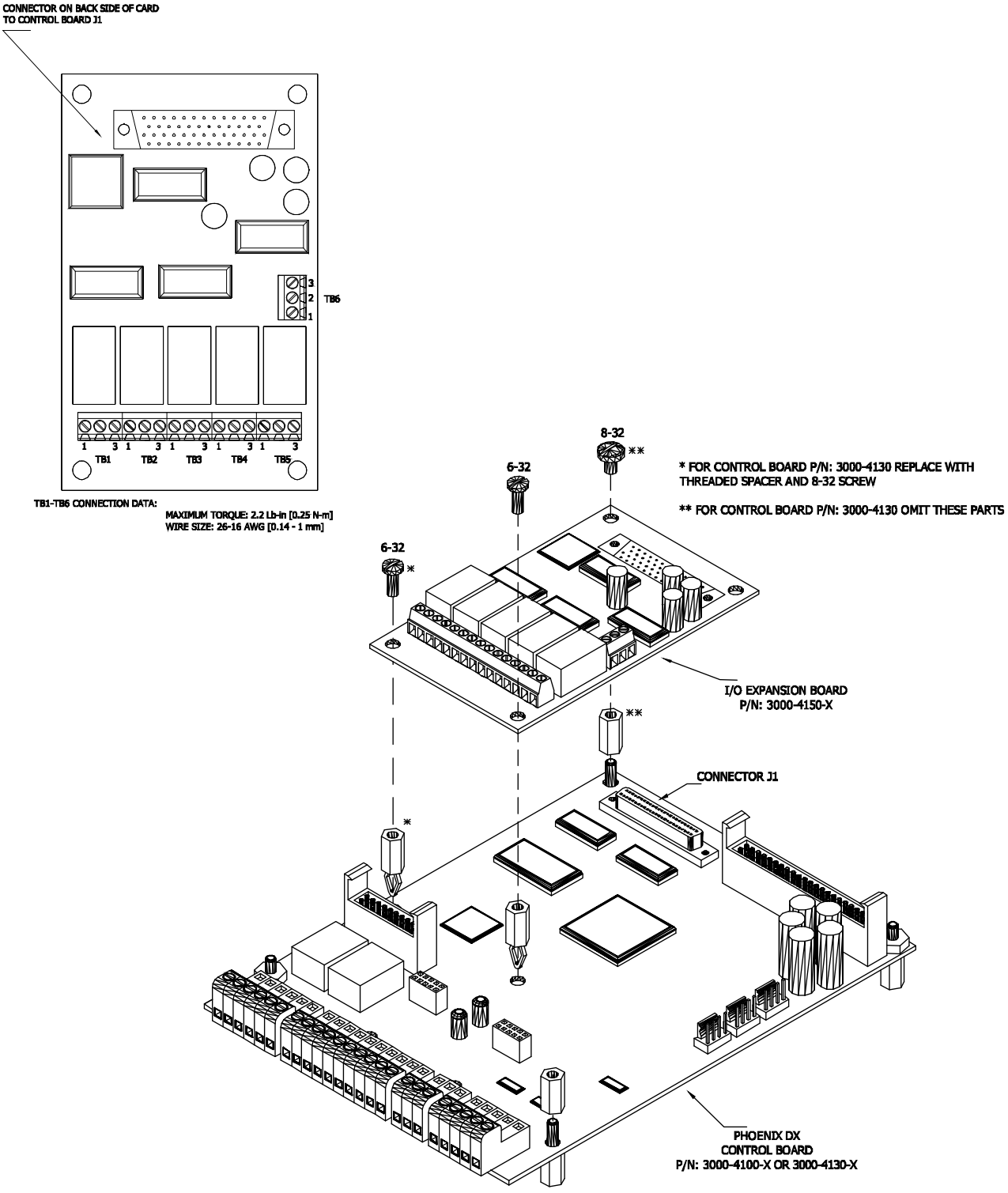
AO = Installed
= Not Installed

Digital Outputs

D1 = 1 Installed
D2 = 2 Installed
D3 = 3 Installed
D4 = 4 Installed
D5 = 5 Installed
= None Installed

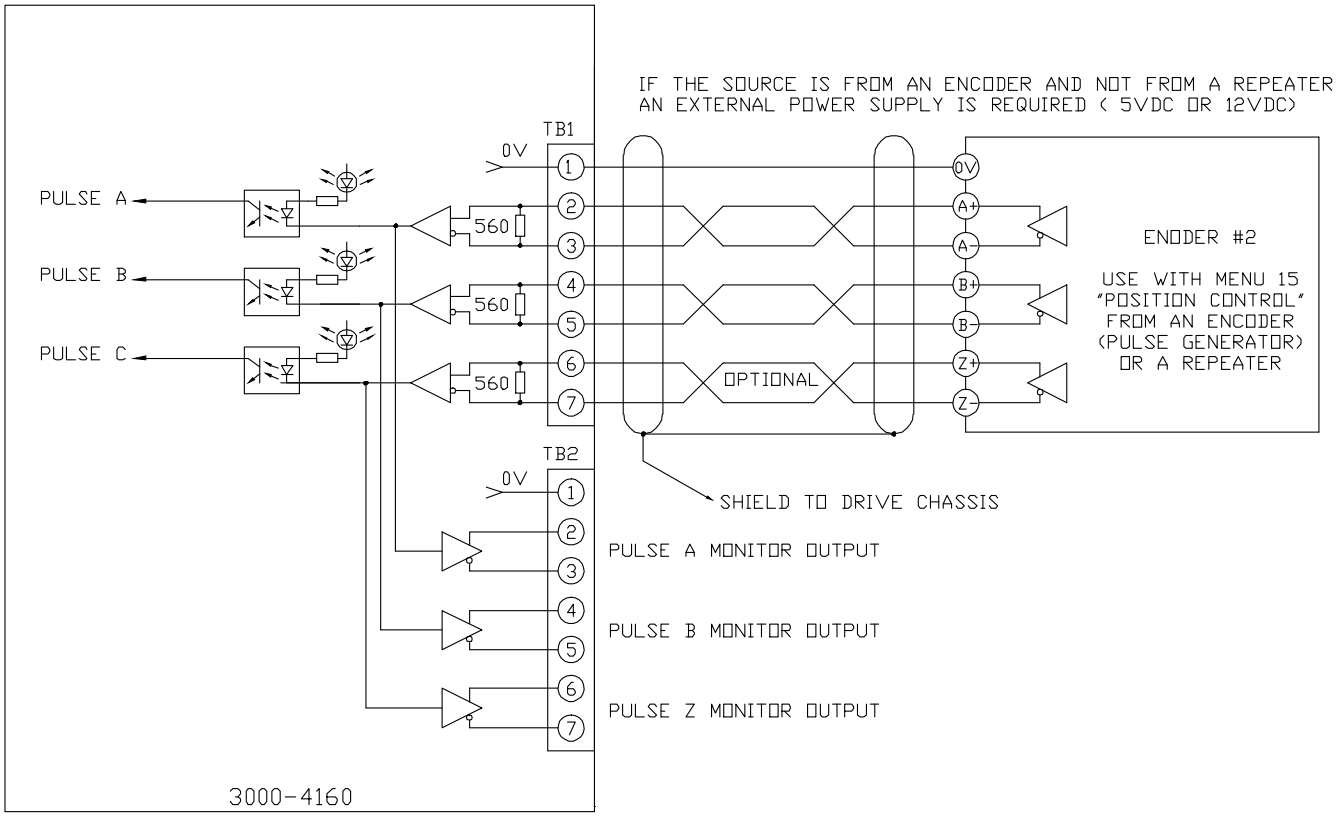


I/O Expansion Board 3000-4150 (2 of 2)



Mounting Diagram

Digital Encoder #2 3000-4160 (Page 1 of 3)



Terminal Block	No.	Signal	
	1	COM	0V reference for A, B, & Z inputs
	2	A+	A Phase Differential Input: 5 to 12VDC Max @ 20mA Max Maximum Input Frequency = 300Khz
	3	A-	
	4	B+	B Phase Differential Input: 5 to 12VDC Max @ 20mA Max Maximum Input Frequency = 300Khz
	5	B-	
	6	Z+	Z Phase Differential Input (optional): 5 to 12VDC Max @ 20mA Max Maximum Input Frequency = 300Khz
	7	Z-	
TB2	1	COM	0V reference for A, B, & Z outputs
	2	A+	A Phase Differential Output: 5VDC Max @ 20mA max
	3	A-	
	4	B+	B Phase Differential Output: 5VDC Max @ 20mA max
	5	B-	
	6	Z+	Z Phase Differential Output: 5VDC Max @ 20mA max
	7	Z-	

This card is used with Menu 15 "Position Control"

Digital Encoder #2 3000-4160 (Page 2 of 3)

Notes:

- If the source is from an encoder and not from an repeater an external power supply is required (5Vdc or 12Vdc)

- Encoder must be differential-line-driver quadrature type 5-12VDC outputs, capable of supplying 20mA per channel

- Maximum input frequency is 300Khz. Use the following equation to check the encoder maximum frequency:

  $F_{encoder\text{-}Max}(Hz) = \frac{MotorSpeed}{60} * EncoderPPR$

  Where MotorSpeed = Maximum operating speed of the motor in RPM.
  EncoderPPR = Encoder resolution in PPR

  Example: Maximum operating motor speed = 3600 rpm
  Encoder resolution = 1024 PPR

  $F_{encoder\text{-}Max}(Hz) = \frac{3600 \cdot RPM}{60} * 1024 \cdot PPR = 61.44Khz$

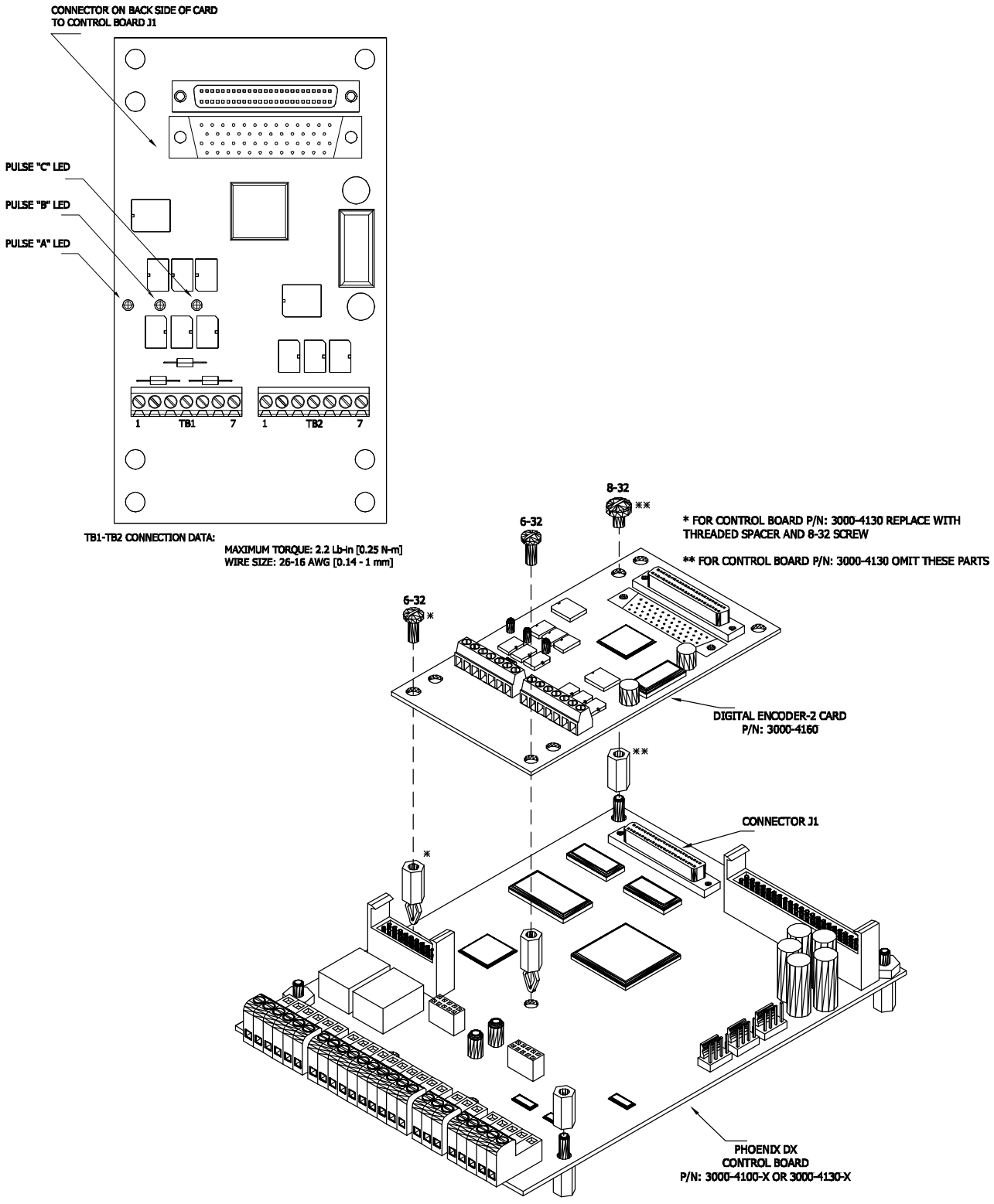
- The encoder cable must be kept from power cables. To prevent erroneous operation caused by noise interference, use shielded cable for control signal and limit distance to 100 meters (330 feet) or less.

- The encoder cable should be made of shielded twisted pair. Twist the shield wires together and connect it through the shortest possible route to the nearest ground terminal at the drive.

- The recommended wire for encoder input/outputs is: cable with pairs individually shielded:
  - Belden 9773 or equivalent - 18 AWG with three pairs individually shielded.
  - Belden 9873 or equivalent - 20 AWGwith three pairs individually shielded.
  - Belden 8777 or equivalent - 22 AWG with three pairs individually shielded.

- The encoder should be insulated electrically from stator or rotor to prevent forming of current path through the encoder. The usual coupling-type encoder must have an electrically insulating coupling. When a hollow-shaft type pulse encoder is used, the insulation can be implemented by insulating the ball joints of the engaging arm, or by insulating the bar of the engaging arm. Shield of the encoder cable should be insulated from the encoder frame.

Digital Encoder #2 3000-4160 (Page 3 of 3)



Mounting Diagram

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POWER CIRCUIT TEST

WARNING: To avoid a hazard of electric shock, after the input and control power is removed from the drive and the ROM display is no longer lit, wait five (5) minutes for DC bus capacitors to fully discharge before opening the drive. Verify that the voltage on the DC bus capacitors has discharged by measuring the DC bus voltage at the +DC & -DC terminals of the drive. The voltage must be zero.

CAUTION: This drive contains ESD (Electrostatic Discharge) sensitive parts and assemblies. Static control precautions are required when installing, testing, servicing or repairing this assembly. Component damage may result if ESD control procedures are not followed.

APPENDIX B-2

PHOENIX POWER CIRCUIT TEST TABLE

WARNING

To avoid a hazard of electric shock, after the input and control power is removed from the drive and the ROM display is no longer lit, wait five (5) minutes for DC bus capacitors to fully discharge before opening the drive to make this test. Verify that the voltage on the DC bus capacitors has discharged by measuring the DC bus voltage at the +DC & –DC terminals of the drive. The voltage must be zero.

Fuse Check :
Check all fuses. Do not replace any fuse before performing the following checks. Please note if an on-board fuse (soldered to the control or power board) is open do not attempt to replace it. An open on-board fuse indicates a damaged board.

Visual Check:
Check all fuses, boards, wire harnesses, connectors, bus bars and enclosure walls for discoloration & damage of components.

Ohmic Check

Size 0:
Check D7 through D18 for shorts using meter set for diode check. These diodes are located on inverter board (lower board). To access these diodes remove only bottom endplate (2.5"x8.75") held by two screws only. In the same area also check for burnt or discolored resistors R19 to R30.

Size 1, 2 & 3:
Check IGBT personality boards P/N: 3000-2020, 3000-2025, 3000-2030, 2085 for the following:
- Burnt or discolored resistors R1, R2, & R3 (6 sets per drive)
- Shorted D1 & D2 using meter set for diode check (6 sets per drive).

These personality boards are either soldered or screwed on the IGBT's (power transistors).

Size 0 Through 3

+ Lead	– Lead	Meter setting	Reading	
L1	L2	20k ohms	OL	
L2	L3	20k ohms	OL	
L1	L3	20k ohms	OL	
U	V	200K ohms	10-30K Ω	
V	W	200K ohms	10-30K Ω	
W	U	200K ohms	10-30K Ω	
DC +	DC –	DIODE	Charge to OL	
DC –	DC +	DIODE	0.5V-0.8V	
L1, L2, L3	DC +	DIODE	OL, OL, 0.5V-0.8V (with SCR precharge)	
L1, L2, L3	DC +	DIODE	0.5V-0.8V (with Contactor precharge)	
DC +	L1, L2, L3	DIODE	Charge to OL	
DC –	L1, L2, L3	DIODE	0.5V	
L1, L2, L3	DC –	DIODE	Charge to OL	
L1, L2, L3, DC+	GND	200k ohms	OL	
DC –, U, V, W	GND	200k ohms	OL	
DC–	U, V, W	DIODE	0.3V-0.5V	
U, V, W	DC+	DIODE	0.3V-0.5V	

Size 0 DC+ and DC- are on connector P11 (Vc+ & Vc-) top board (4000-4130).

For Size 2 Drive:

U, V, W	- Right side of bus fuse	DIODE	0.3V-0.5V	
Left side of bus fuse	- Right side of bus fuse	20K	0.002-0.005KΩ	

Bus fuse located at bottom of enclosure.

For Size 3 Drive:

Top of bus fuse	U, V, W	DIODE	0.3V-0.5V	
Top of bus fuse	- Bottom of bus fuse	20K	0.002-0.005KΩ	

Bus fuse located at bottom of enclosure.

WARRANTY

US Drives, Inc. warrants the equipment described in this manual for thirty-six (36) months from the day of purchase, not to exceed forty (40) months from date of manufacture. US Drives further warrants that such goods are free of defects in materials and workmanship.

If the goods fail to perform to US Drives published specifications, then the Buyer must contact US Drives to obtain a Return Material Authorization (RMA), prepare the goods for shipment, and return the goods to US Drives for repair or replacement at US Drives Option. The buyer will bear all costs of transportation to and from US Drives factory, risk of loss for goods not at US Drives factory, and any cost required to remove or prepare the goods for shipment to US Drives factory and to reinstall equipment subsequent to repair.

In no event and under no circumstances shall the manufacturer be liable for: (a) damages and failures due to improper use or installation; (b) damage in shipment; (c) damage to abnormal conditions of temperature, dust, or corrosives, or failures due to operation above rated capacities, whether intentional or unintentional; (d) non-authorized service, repair, modification, transportation or installation. Nor shall the manufacturer ever be liable for consequential or incidental damages including any lost profits or lost savings.

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The warranty is effective only if a written notification of any claim under this warranty is received by US Drives at the address indicated below within thirty (30) days of recognition of defect by buyer.

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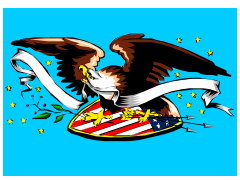

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