

TROOPER[®] PRO

DIGITAL D.C. MOTOR CONTROL

Instruction Manual

Models

TPR902-000

TPR902-E00



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General Description

The Trooper® Pro Series is a microprocessor based D.C. motor control. The series provides control of speed and torque control of 1/8HP-2HP D.C. motors. The controls are offered in chassis (-000) and NEMA 4 enclosed (-E00) assemblies. Some standard features are listed below:

- Operates at 115/230VAC input for 90/180VDC motor armatures
- Same footprint/package as analog Trooper® series
- Armature voltage feedback, tachometer feedback, and encoder feedback
- Power On/Off switch (enclosed models only)
- 9 button keypad with 2 line by 16 character display
- USB connectivity
- Compatible with Carotron's free CaroLink software
- Option port

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Specifications

2.1 Electrical

A.C. Input Voltage Range

- 1 phase, 115-230VAC \pm 10%, 50/60 Hz \pm 2 Hz, 15A

Armature Output

- 0-90VDC @ 115VAC input
- 0-180VDC @ 230VAC input

Field Output

- 50/100VDC, 1A @ 115VAC input
- 100/200VDC, 1A @ 230VAC input

Horsepower Range

- 1/8-1HP @ 90VDC
- 1/4-2HP @ 180VDC

Power Supplies

- +24 VDC (TB1-1): 50mA
- +15 VDC (TB1-10): 50mA
- +10 VDC (TB1-4): 50mA

Digital Inputs (Qty: 5)

- Sink Mode
 - V_{ih} =20.0 VDC max
 - V_{il} =0.0 VDC min to 17.0 VDC max
- Source Mode
 - V_{ih} =8.0 VDC min to 30.0 VDC max
 - V_{il} =5.0 VDC max
- Current Consumption
 - 5mA each (with 24V supply)

Analog Inputs (Qty: 2)

- Voltage Mode
 - Max Input: \pm 11 VDC
 - Input Impedance: 100K Ω
- Current Mode (AI2 only)
 - Max Input: \pm 22 mADC
 - Input Impedance: 150 Ω
- Resolution: 12 bit

Tachometer Feedback/High Voltage Analog Input

- Max Input: \pm 200 VDC

Encoder Feedback/Frequency Input

- Frequency: 50kHz max, square wave
- Uni-directional (single channel)
- Single ended
- Voltage: 15 VDC max
- V_{il} =0.0 VDC to 1.5 VDC max
- V_{ih} =2.5 VDC min to 15.0 VDC max

Relay Outputs (Qty: 2)

- 2 A @ 115 VAC (resistive)
- 2 A @ 60 VDC (resistive)
- 1 Form A, 1 Form C

Analog Outputs (Qty: 2)

- \pm 10 VDC max, 20mADC max
- Resolution: 12 bit

Speed Regulation

- Armature Feedback: \pm 0.5% of base speed
- Tachometer Feedback: \pm 0.25% of base speed
- Encoder Feedback: \pm -0.25% of base speed

Torque Regulation

- \pm 1% of Range Selected

Speed Range

- 20:1 typical when using tachometer or encoder feedback. May be less depending upon motor characteristics

Temperature Range

- Chassis: 0-55 $^{\circ}$ C
- Enclosed: 0-40 $^{\circ}$ C

2.2 Physical

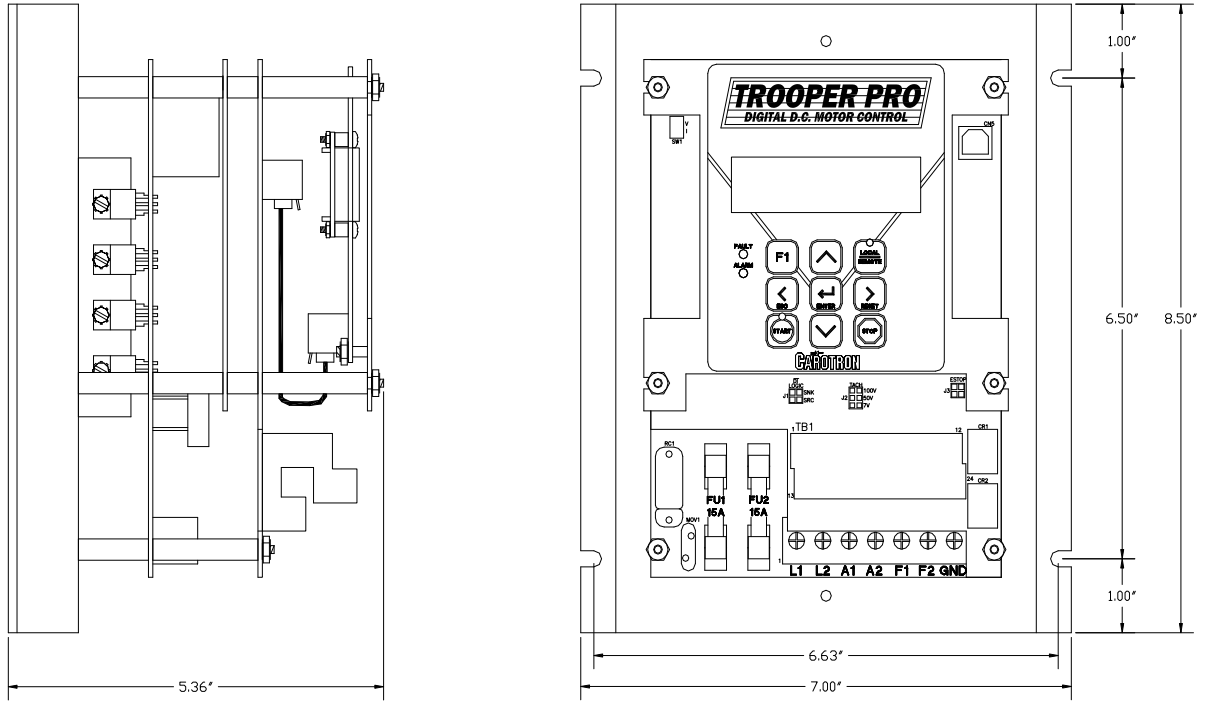


Figure 1: Chassis Models

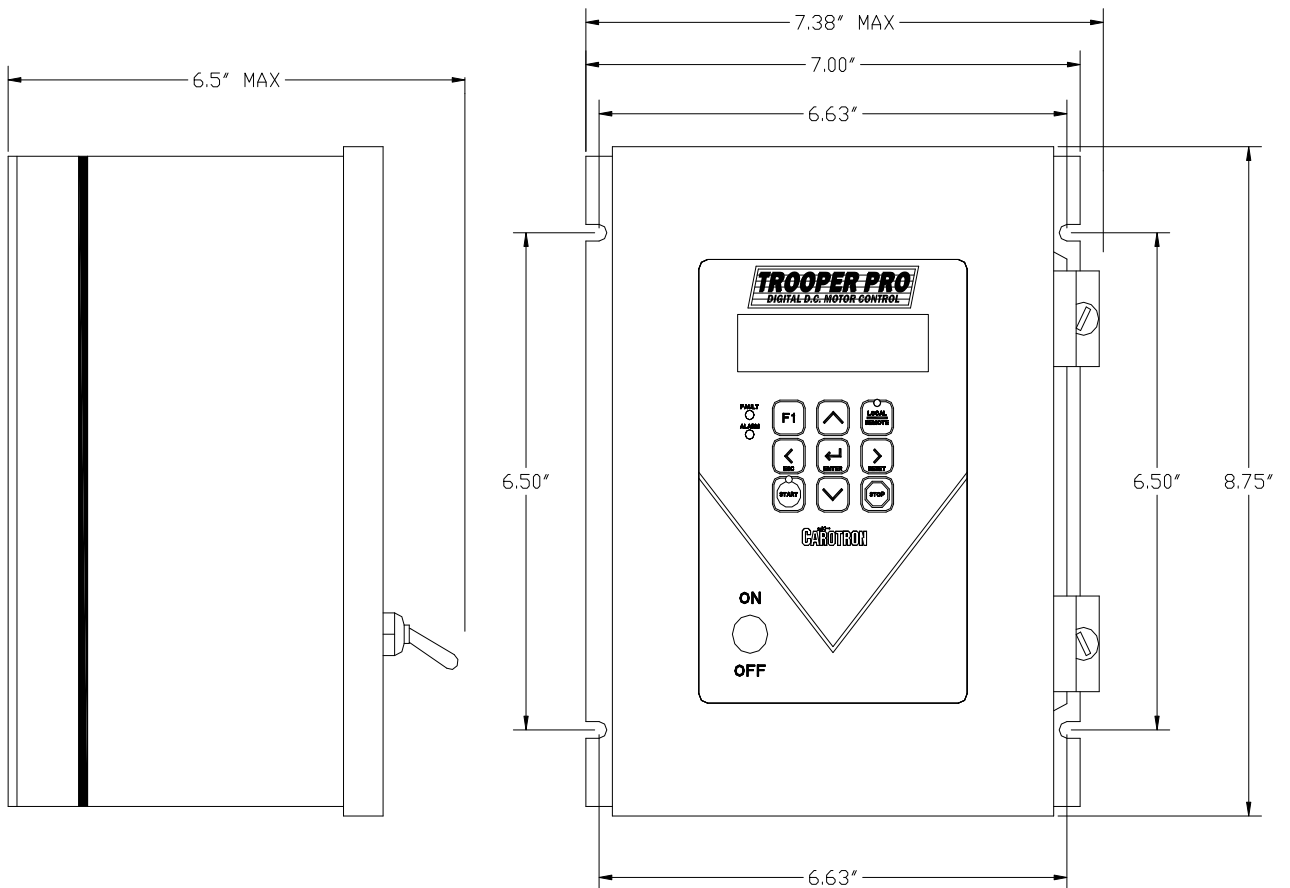


Figure 2: Enclosed Models

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Installation

3.1 Control Installation

Trooper® Pro motor controls require mounting in an upright position in an area that will permit adequate airflow for cooling and ready access for making connections and for servicing. Because cooler air is drawn in from the bottom and exhausted from the top, these areas should be kept clear for about a six inch distance. Stacking of controls with one mounted above the other should be minimized so that the upper control is not ventilated with hot exhaust air from the lower control.

Enclosures should be sized to provide adequate surface area for dissipating heat or provided with forced ventilation with outside air from a duct system or enclosure fan. They should be mounted to a cool surface not exposed to heat generated by nearby equipment.

Excess ambient temperatures within enclosures can reduce the life expectancy of electronic components and can failure of the Trooper® Pro control. Contact Carotron for assistance in sizing enclosures for particular horsepower ratings.

3.2 Wiring Guidelines

To prevent electrical interference and to minimize start-up problems, adhere to the following guidelines.

Make no connections to ground other than the designated terminal strip location.

Use fully insulated and shielded cable for all signal wiring. The shield should be connected at one end only to circuit common. The other end of the shield should be clipped and insulated to prevent the possibility of accidental grounding.

Signal level wiring such as listed above should be routed separately from high level wiring such as armature, field, and relay control wiring. When these two types of wire must cross, they should cross at right angles to each other.

Any relays, contactors, starters, solenoids or electro-mechanical devices located in close proximity to or on the same line supply as the motor control should have a transient suppression device such as an MOV or R-C snubber connected in parallel with its coil (for AC coils). Diode suppression should be used for DC coils. The suppressor should have short leads and should be connected as close to the coil as possible.

Drive Model	Motor HP	AC Input Voltage	Approx. Full Load Line Amps	Recommended Fuse (Amps)	Armature Amps	Armature Volts
TPR902-000	1/8	115	2.3	3	1.5	90
	1/4		4.3	5	3	
	1/2		7.9	8	6	
	3/4		11.7	15	8	
	1	230	15	15	10	180
	1/4		2.3	3	1.5	
	1/2		4.3	5	3	
	1		7.9	8	6	
1-1/2	12.2	15	8			
2	15	15	10			

Table 1: Model Rating Data

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Terminal Connections & Functions

4.1 AC Power Connections

Terminals L1 and L2 are the AC line inputs. Refer to **Figure 3** below. Fusing is provided on board. Refer to Table 1 above for recommended fuse sizing.

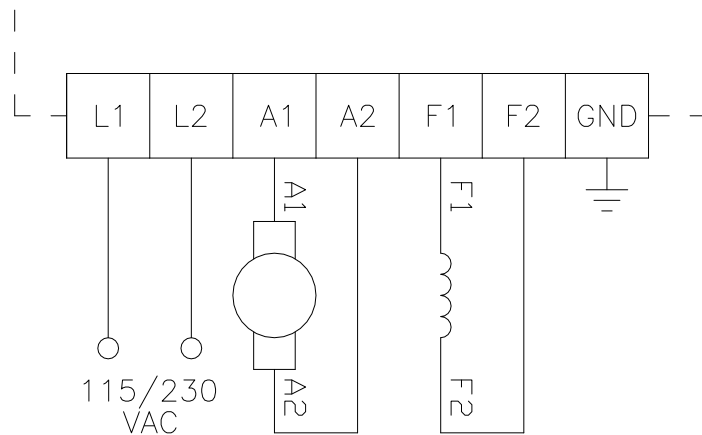


Figure 3: Power Connections

4.2 Motor Connections

Field

Many small motors are permanent magnet type or "PM" motors. These motors use magnets instead of an electro-magnet winding. When using these motors, no connections are made to the F1 and F2 terminals.

A motor that has an electro-magnetic field winding will typically come in two types: single or dual winding. A motor with a single field winding will be connected as shown in **Figure 3**. Most modern motor fields consist of two windings that are connected in parallel for low voltage operation and in series for high voltage operation. Refer to **Figure 4**. The winding leads are individually marked and have a polarity that must be observed for proper and safe operation. Since direction of rotation is controlled by field polarity as well as armature polarity, it is sometimes more convenient to swap the smaller field leads when making corrections to the direction of rotation during initial installation. An energized field should **never** be switched by relay, contactor, switch, or any other manual or electro-mechanical device.

When the Trooper® Pro is supplied with 115VAC, the field is typically wired for low voltage operation (i.e. 100VDC). When supplied with 230VAC, the motor field is typically wired for high voltage operation (i.e. 200VDC). The F1 and F3 leads should always have the same polarity regardless of the mode used.

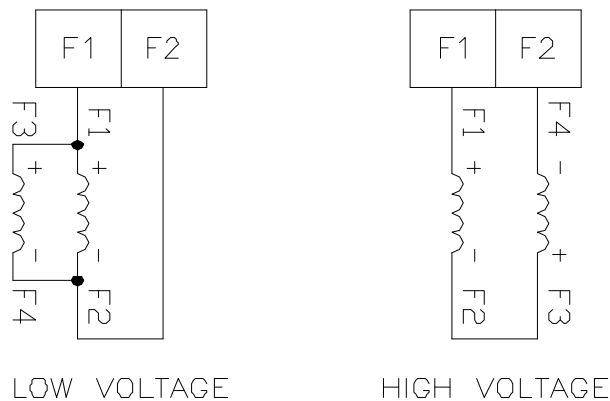


Figure 4: Motor Field Connections

Although rarely needed, a half-voltage field output can be obtained from the drive by connecting the motor field windings across terminals L1 and F2 (instead of F1 and F2). Refer to **Figure 5** below. In these cases, an AC input of 115VAC will produce a field voltage of 50VDC. An input of 230VAC will produce a field voltage of 100VDC.

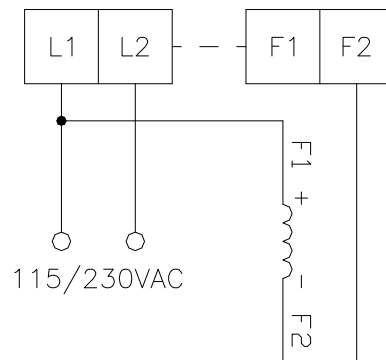


Figure 5: Half Wave Motor Field Connections

Armature

The armature leads are usually the highest current wires associated with the drive and warrant special attention to sizing based on current rating as well as length of run. Extra care should be used where terminations and splices are made. Refer to **Table 1** for typical armature voltage and current ratings. Refer to **Figure 3** for example connections w/o an armature contactor. Refer to **Figure 6** for example connections using an optional external armature contactor. Motor stopping time is determined by inertia and friction characteristics of the load. This time can be decreased by use of an optional dynamic braking (D.B.) resistor.

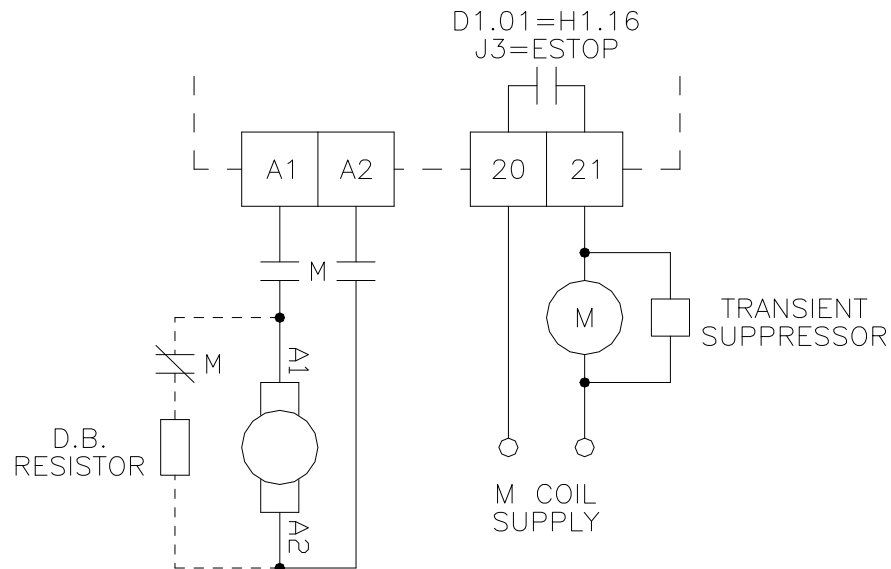


Figure 6: Armature Connections with Optional Contactor

Motor Thermostat

Most motors include "J" or "P" leads that connect to an internal normally closed thermostat. When used, these leads are typically connected in series with the E-STOP or RUN signals. This allows a motor over-temperature condition to shut down the control.

4.3 Signal Connections

Figure 7 shows the typical signal connections to an Trooper® Pro drive. When operated, the Emergency Stop contacts at terminal 3 will immediately clamp all control signals. If an armature contactor is used (via Relay Output 1), it will also de-energize to disconnect the armature from the bridge output.

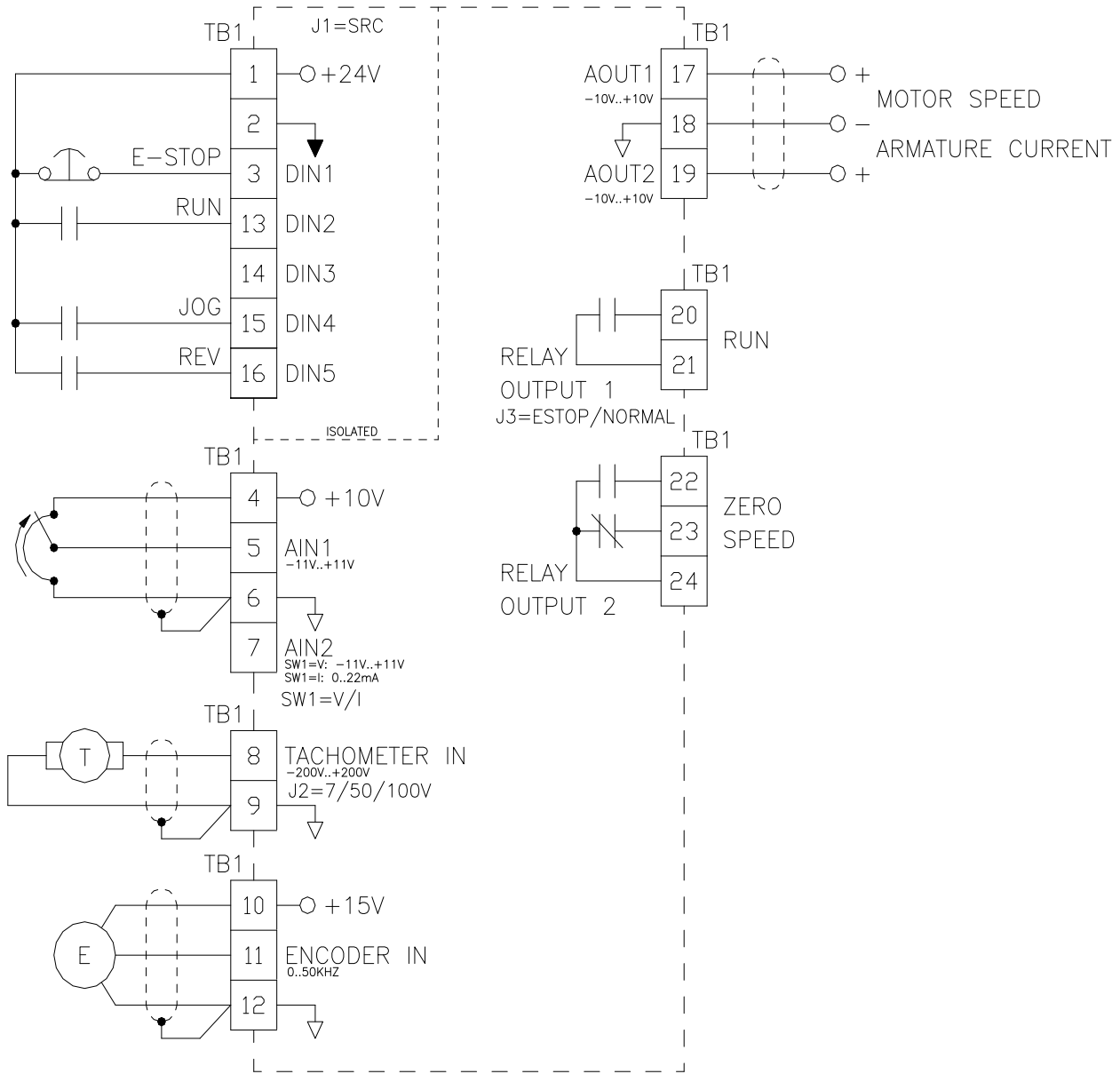


Figure 7: Signal Connections

The Trooper® Pro supports three different start/stop logic schemes (four including the local mode). Refer to **Figure 8** below. The momentary scheme (often called 3 wire) uses momentary pushbuttons to control the starting and stopping of the drive. A selector switch or a contact controls the direction. The other two schemes use maintained contacts (often called 2 wire mode). In the Run/Direction scheme, a single contact starts and stops the drive while another contact selects direction. In the final scheme, each contact starts the drive and selects the direction. Parameter H1.01 needs to be set appropriately.

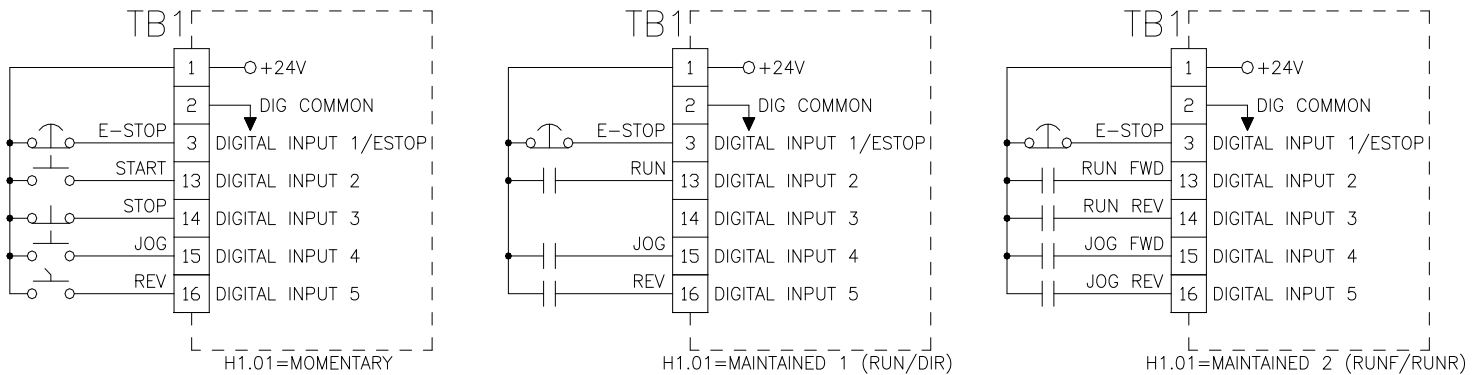


Figure 8: Start Stop Logic

The drive also has the capability to interface with either sinking or sourcing logic controls. Sourcing (PNP) logic is selected by setting jumper J1 to the SRC position. This places an internal pull down resistor on each input. The external switch or sensor must then drive the input high to activate the input. Sinking (NPN) logic is selected by setting jumper J1 to the SNK position. This places an internal pull up resistor on each input. The external switch or sensor must then sink (pull down) the input to common to activate the input. Refer to **Figure 9** below.

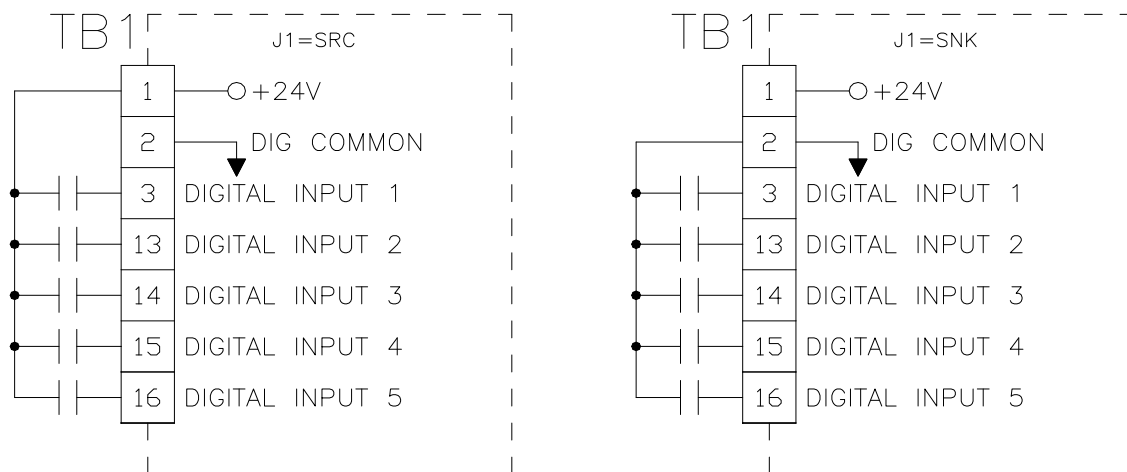


Figure 9: Sink/Source Wiring

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Human Machine Interface (HMI)

5.1 Description of Interface

The Human Machine Interface (HMI) is the primary method for accessing the drive's parameters. It allows for custom user configuration, monitoring, and troubleshooting. As seen in Figure 10, the HMI consists of a 2 line by 16 characters display, 9 button keypad, and 4 LEDs.

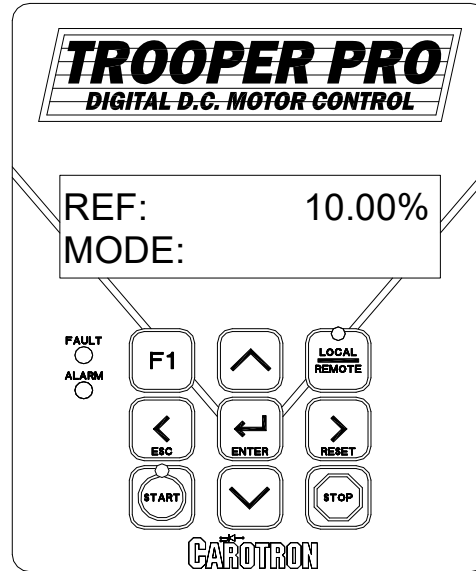


Figure 10: Keypad

Index	Item	Description
1	F1	Softkeys. The functionality of this key varies depending upon the displayed menu. When utilized, text above the key displays its function.
2	Start Key	Places the drive in run mode when in local mode
3	Stop Key	Stops the drive in all modes
4	Esc/Left Key	<ul style="list-style-type: none"> Returns to the previous menu Moves cursor one place to the left
5	Reset/Right Key	<ul style="list-style-type: none"> Clears drive fault (on a DM screen) Moves cursor one place to the right
6	Local/Remote Key	Switches the drive between local and remote control
7	Enter Key	<ul style="list-style-type: none"> Used to accept/enter parameter values Moves cursor one place to the right
8	Up/Down Keys	<ul style="list-style-type: none"> Scrolls to the next menu display Increments/decrements cursor value
9	Run LED	On: Drive is in run mode and has reference Flashing: Drive is in run mode with no reference Off: Drive is not in run mode
10	Local LED	On: Drive is in Local mode Off: Drive is in Remote mode
11	Alarm LED	On: An alarm is present Off: No alarms present
12	Fault LED	On: A fault is present. Fault is not active and can be reset. Flashing: Fault present and currently active. Cannot be reset. Off: No faults present

Table 2: HMI Description

When power is applied to the drive, the HMI displays the drive's firmware version. After a short timeout, the Drive Monitor 1 (DM01) screen is displayed. Navigation through the menu is achieved by using the Up, Down, Left, Right, Escape, and Enter keys.

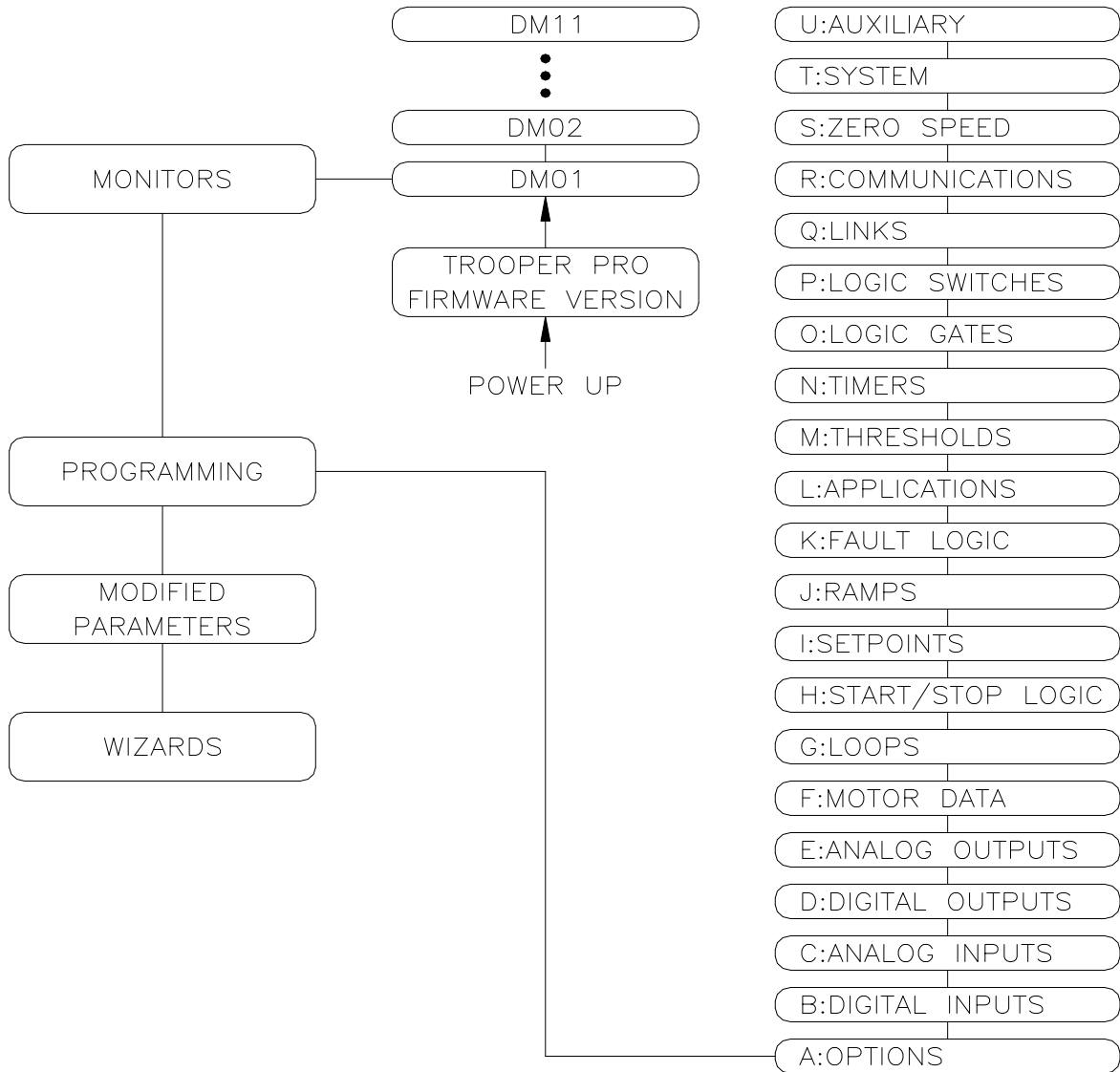


Figure 11: Menu Structure

Monitors

The Monitors section contain the Drive Monitor screens. Each of these screens displays various drive status information.

Monitor	Description
DM01	Reference/Mode
DM02	Reference/Act Speed
DM03	Local Direction
DM04	Local Jog
DM05	Armature Status
DM06	Fault Status
DM07	Alarm Status
DM08	Velocity Loop Status
DM09	Current Loop Status
DM10	Loop Outputs
DM11	Tachometer Status
DM12	Encoder Status
DM13	Drive Model/Firmware

Table 3: Drive Monitor Descriptions

Programming

The drive parameters are located under the Programming section. Each drive parameter has a unique identifier tag that consists of an alpha group code, and numeric block code, and a two digit numeric index. For example, parameter C2.04 is in Group C, Block 2, and Index 4. When the programming section is first displayed, the first parameter (A1.01) is displayed with the Group Code flashing (i.e. the 'A'). The Up/Down keys are then used to change the Group Code to the desired value. Pressing the Reset/Right key will move the cursor to the right and cause the Block Code to begin flashing. The Up/Down keys are then used to change the Block Code. Pressing the Reset/Right key will move the cursor to the right and cause the Index Code to begin flashing. The Up/Down keys are used to change the Index to display the desired parameter. Pressing Escape/Left key will move the cursor left.

Once a parameter is displayed, pressing the Enter key will allow its value to be modified. The current value of the parameter (or a digit in its value) will begin flashing. The Up/Down keys are used to adjust the value. If the parameter is a numeric value, the Reset/Right key can be used to shift the cursor to the right to allow other digits to be adjusted. Pressing the Reset/Right key when the cursor is on the last digit will cause the cursor to be placed on the first digit. Once the desired value is displayed, the value can be entered by pressing the Enter key. The Escape/Left key will move the cursor to the left. Pressing this key when cursor is in the left most column will exit the parameter adjustment screen without changing the parameter value.

Note: When parameters are altered via the keypad, the changes are saved automatically.

Modified Parameters

This section contains a list of parameters that have been modified from the default factory preset value. The Up/Down keys are used to scroll through the list. Press the Enter key to edit the value.

Wizards

This section contains various drive related wizards that aid in drive setup.

6

Start Up Procedure

6.1 Pretest

1. Verify incoming power supply voltage. Input voltage should be checked ahead of the supplying circuit breaker, disconnect switch, etc. before it is switched on.
2. Connections should be visually inspected and checked for tightness. An ohmmeter can be used to check for ground faults. **Ground faults** in un-isolated circuits of the armature and field can cause fuse blowing and damage to the motor and control. To check for grounds with an ohmmeter, select a high resistance scale such as R x 100K ohms or greater. Test from each connection terminal (including shields) to chassis ground and be suspicious of any resistance reading less than 500K ohms.
3. Adjust external reference (Analog Input 1) at terminal 5 to 0 volts.
4. Apply power. On initial power up, the drive should display an Invalid Motor Data fault. Press CLOSE to exit. When asked to run the Basic Setup Wizard, select YES. If the wizard was cancelled, it can be re-started from the Wizards section in the menu.

6.2 Adjustment Procedure: Velocity (Speed) Regulator

1. Presets
Use the Basic Setup Wizard to set the required parameters. The wizard will step you through various drive parameters. When a parameter is displayed, press the ENT key to edit its value. There are a number of required parameters. The wizard will not allow you to proceed until a valid value has been entered. It is recommended that the drive initially be setup using armature feedback even if a tachometer or encoder will be used. This allows the proper feedback signal to be verified before using it for control.
2. Clear any Faults
When the wizard is completed, the drive will try to clear any faults that are present. If a fault is still present (i.e. the Fault LED is on or flashing), navigate to the DM06 screen to display the current fault. Once the fault condition is removed, the fault can be cleared by pressing the RESET key while on any DM screen.
3. Validate E-STOP
This step is only required when using an external E-STOP. If not used, a jumper may be wired in place of the E-STOP switch or the function of Digital Input 1 may be altered. When an E-STOP is activated, the status display on the DM01 screen should display E-STOP. When the E-STOP is cleared, the status should display STOP or FAULT. If the E-STOP status is not displayed correctly, check the wiring. Also ensure jumper J2 is in the proper position. Refer to Figure 7. Do not proceed until the E-STOP functions properly.
4. Safety Check
During the following steps the motor will be rotated. If excessive speed or wrong direction of rotation could damage the load, it may be wise to de-couple the load until proper control is verified.
5. Check Motor Rotation
While displaying the DM01 screen, place the drive in local mode by pressing the LOCAL/REMOTE key. The Local LED should be on. Press the Up key until DM04 is displayed. Press and hold the F1 key to jog the drive. The armature contactor should close and the motor should rotate slowly. Observe the direction of rotation. Release F1 to stop the drive. If the motor rotation is reversed, remove all power and reverse the motor armature or field wires. After re-applying power, repeat this step to verify motor direction.
6. Validate External Start/Stop

Press the LOCAL/REMOTE key to return the drive to Remote mode. The Local mode LED should be off. Adjust the external reference signal connected to terminal 5 to its minimum. Typically, the reference value on DM01 should be approximately zero. Place the drive in Run mode via the external contacts. Slowly increase the external reference until the motor is rotating. Issue a stop command using the external contacts and verify the motor stops and the contactor de-energizes.

7. Validate Reverse Direction

This step is optional and only required if reverse direction is needed. With reference at minimum, run the drive in the reverse direction. Slowly increase the reference and verify motor runs in reverse direction. Stop drive.

8. Validate Tachometer Feedback (required only if a motor mounted tachometer is used)

Proper tachometer operation should be checked while the drive is running in Armature Feedback. Place the drive in run mode and run at a low speed (approximately 20%). On the display, navigate to DM11. Compare Armature feedback to Tachometer feedback. The values should be approximately equal (within 5%). If the values have approximately the same value but the wrong polarity, press the Stop button and invert the tachometer feedback by setting parameter **F2.02** to On. Place the drive back in the run mode and re-check. If the values are not equal, verify the tachometer jumper J2 is set properly. Once corrected and the values are equal at low speeds, increase speed and check at higher speeds. If the values are approximately equal throughout the speed range, the drive can be placed in tachometer feedback. With the drive in the stop mode, set parameter **G2.15** to Tachometer. Run drive and verify proper operation.

9. Validate Encoder Feedback (required only if a motor mounted encoder is used)

Proper encoder operation should be checked while the drive is running in Armature Feedback. Place the drive in run mode and run at a low speed (approximately 20%). On the display, navigate to DM12. Compare Armature feedback to Encoder feedback. The values should be approximately equal (within 5%). If the values have approximately the same value but the wrong polarity, press the Stop button and invert the encoder feedback by setting parameter **F3.03** to On. Place the drive back in the run mode and re-check. If the values are not equal, verify the encoder data is entered properly in section F2 (or the wizard). Once corrected and the values are equal at low speeds, increase speed and check at higher speeds. If the values are approximately equal throughout the speed range, the drive can be placed in encoder feedback. With the drive in the stop mode, set parameter **G2.15** to Encoder. Run drive and verify proper operation.

6.3 Adjustment Procedure: Torque (Current) Regulator

1. Presets

Set up the Trooper® Pro drive as a normal velocity regulator to run at the motor's base speed using armature feedback. Refer to Section 6.2. Once correct operation in this mode has been achieved, proceed with the following steps.

2. Parameters

Re-run the Basic Setup Wizard and set the Operating Mode to TORQUE. Continue through the wizard and enter any required data.

3. Test

With reference at minimum, place drive in run mode. Navigate to DM05 to display the armature current. Slowly increase reference and verify control of armature current.

6.4 Calibration & Fine Tuning

1. If the drive is using armature feedback (i.e. G2.15 is set to ARMATURE), then **IR**

Compensation (G2.09) can be adjusted to improve the speed regulation with load changes. Adjustment is best done when the motor or machine can be loaded normally. If the motor is normally operated at a particular speed, adjust **IR Compensation (G2.09)** while running at that speed. If the motor operates under load over a wide speed range, pick a speed near mid-range to make the adjustment. Adjust as follows:

Operate the unloaded motor at the normal or mid-range speed and note the exact speed using a hand tachometer or other speed measuring device. While still monitoring speed, apply normal load. The reduction in speed of a fully loaded motor will usually fall between 2 and 13% of rated or "base" speed. Slowly increase **IR Compensation (G2.09)** until the loaded speed equals the unloaded speed measured in the previous step. Making this adjustment may now cause the unloaded speed to be slightly higher. Repeat this procedure until there is no difference between loaded and unloaded speed levels. Use care not to set the adjustment too high or speed increase with load and instability may result. NOTE: For this adjustment, do not use armature voltage feedback (AFB) to measure speed. Armature voltage is not an exact indication of loaded motor speed!

2. The **Current Proportional Gain (G1.16)**, **Current Integral Time (G1.17)**, **Velocity Proportional Gain (G2.21)**, and **Velocity Integral Time (G2.22)** parameters are preset by Carotron to provide stable and responsive performance under most load conditions. When required, the drive performance can be optimized for a particular application or to correct undesirable operation by use of these adjustments. The adjustments are complex though and can adversely affect operation if not properly set. In general, the settings that give the most stable operation do not always give the fastest response.

6.5 Password Protection

If password protection is required, set the appropriate password under A1.04. Please note that this is a special hidden parameter. You must first display A1.03. Then press F1 key and then the Up key to display A1.04. Once A1.04 has a value other than zero, parameters can be viewed but cannot be changed. Changes can only be made by first entering the password into parameter A1.05. Once all changes have been made, A1.05 can be manually returned to 0 to logout. The drive also has a timeout feature, that automatically clears the entered password in A1.05 after 5 minutes.

7

Programming & Adjustments

Programming and adjustment of the Trooper® Pro is accomplished by changing parameter settings. Each parameter has a Tag identifier and a descriptive name. Parameters are separated into groups and blocks according to their function. The following sections contain each software block diagram and descriptions of each parameter function. Refer to Figure 12 for key conventions that are used in the block diagrams. Each parameter is one of three types: Read-Write (RW), Inhibit Change while Running (ICR), or Read-Only (RO). ICR parameters can be changed only when the drive is not running.

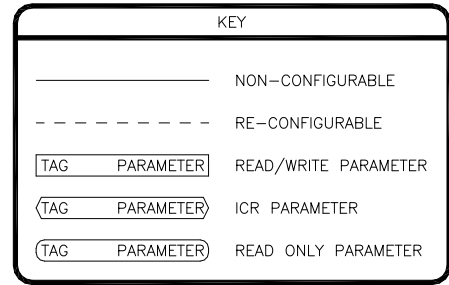


Figure 12

7.1 A: Options

These parameters set the drive's basic operating mode.

A1: Options

A1.02 Operating Mode (ICR, Preset: Velocity)

Sets the drive's operating mode.

VELOCITY

Drive regulates motor speed.

TORQUE

Drive regulates motor torque (or armature current).

A1.03 Initialize (ICR, Preset: 0)

9999: Re-initializes the drive and returns all parameters to the factory default setting.

Range: 0..65535

A1.04 Define Password (R/W, Preset: 0)

A numeric password may be set to prevent unauthorized parameter changes. After a numeric password has been entered, the drive allows all parameters to be viewed, but prevents changes from being made. Only after a valid password has been entered into A1.05 can changes be made. This parameter requires a special keystroke to display. With A1.03 displayed, press F1 and then UP. Range: 0..65535

A1.05 Enter Password (R/W, Preset: 0)

If a numeric password has been defined in parameter A1.04, the same password must be entered into parameter A1.05 before any parameter changes can be made. As a security feature, the drive automatically clears the entered password after 5 minutes. Range: 0..65535

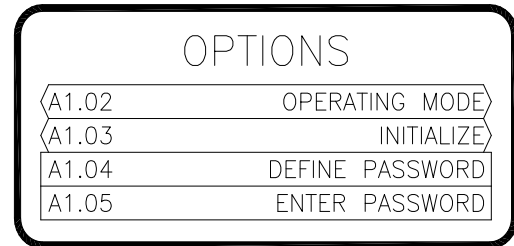


Figure 13

7.2 B: Digital Inputs

These parameters configure the drive's physical digital inputs (digital & frequency).

B1: Digital Input 1

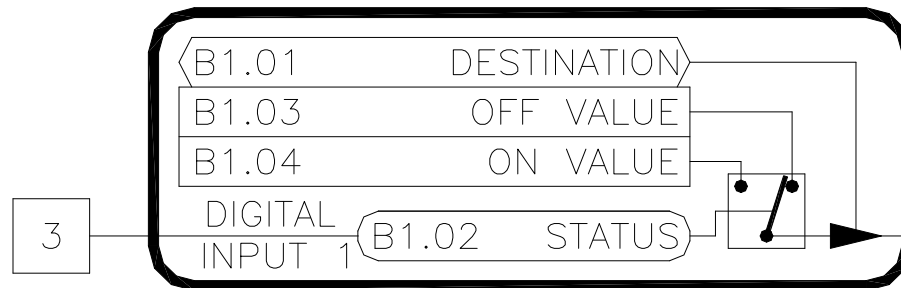


Figure 14

B1.01 Digital Input 1 Destination (ICR, Preset: H1.12 [Ext Run Enable])

Determines the function of the digital input. Each digital input can control (or write to) any R/W parameter in the drive. The destination parameter contains the tag of the parameter the input will control (i.e. the target parameter). Refer to Table 4 for a list of commonly used functions.

Value	Function
H1.02	Start-Run-Run Fwd*
H1.03	NA-/Stop-Run Rev*
H1.04	Jog-Jog-Jog Fwd*
H1.05	Rev-Rev-Jog Rev*
H1.08	/Coast Stop
H1.09	/Quick Stop
H1.10	/Dynamic Brake Stop
H1.12	Ext Run Enable (E-Stop)
I1.01	Aux Reference Enable
I1.02	Ref Select (MSB)
I1.03	Ref Select (LSB)
J1.18	Ramp 1 Bypass
K1.14	External Fault
K1.15	Fault Reset
L1.01	PID Enable
L1.02	PID Reset
L6.01	MOP Increase
L6.02	MOP Decrease
L6.07	MOP Reset

Table 4: Common Digital Input Functions

*The actual function is determined by the H1.01 setting.

B1.02 Digital Input 1 Status [Terminal 3] (RO)

Displays the status of the digital input. A value of **OFF** indicates the digital input is off or not activated. A value of **ON** indicates the digital input is on or active.

B1.03 Digital Input 1 Off Value (RW)

This is the value written to the target parameter when the digital input's status is **OFF**. The limits and units of these parameters will change to match the limits and units of the target parameter.

B1.04 Digital Input 1 On Value (RW)

This is the value written to the target parameter when the digital input's status is **ON**. The limits and units of these parameters will change to match the limits and units of the target parameter.

B2: Digital Input 2

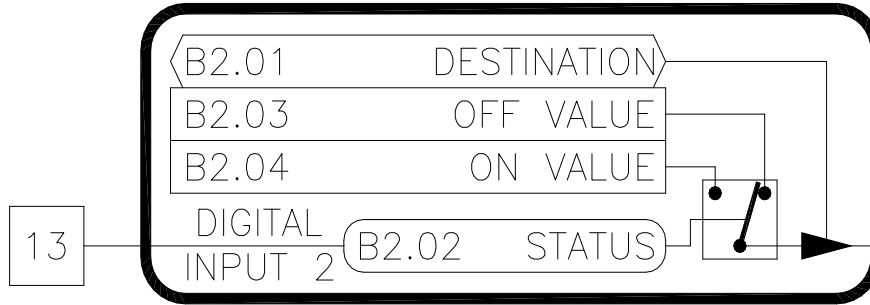


Figure 15

Digital Input 2 is functionally equivalent to Digital Input 1. Refer to B1.XX

B2.01 Digital Input 2 Destination (ICR, Preset: H1.02 [Run])

B2.02 Digital Input 2 Status (RO)

B2.03 Digital Input 2 Off Value (RW)

B2.04 Digital Input 2 On Value (RW)

B3: Digital Input 3

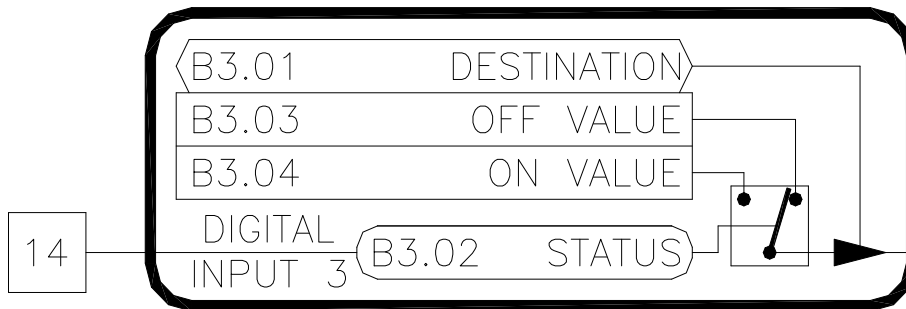


Figure 16

Digital Input 3 is functionally equivalent to Digital Input 1. Refer to B1.XX

B3.01 Digital Input 3 Destination (ICR, Preset: H1.03 [/Stop])

B3.02 Digital Input 3 Status (RO)

B3.03 Digital Input 3 Off Value (RW)

B3.04 Digital Input 3 On Value (RW)

B4: Digital Input 4

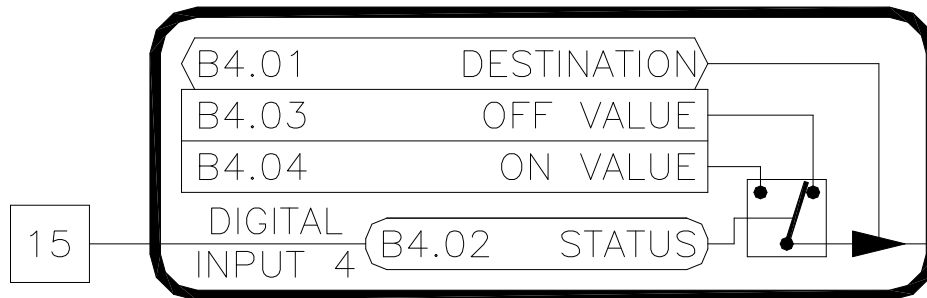


Figure 17

Digital Input 4 is functionally equivalent to Digital Input 1. Refer to B1.XX

B4.01 Digital Input 4 Destination (ICR, Preset: H1.04 [Jog])

B4.02 Digital Input 4 Status (RO)

B4.03 Digital Input 4 Off Value (RW)

B4.04 Digital Input 4 On Value (RW)

B5: Digital Input 5

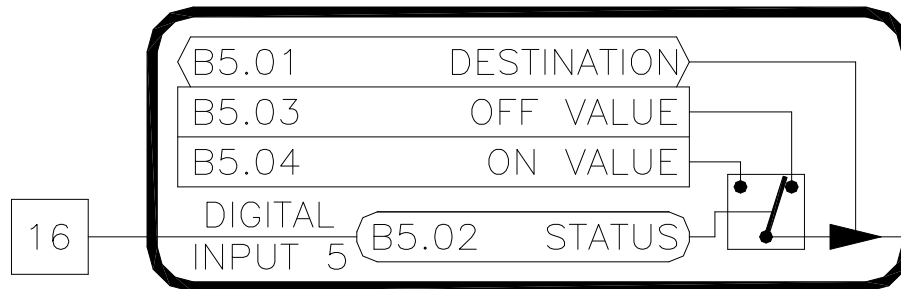


Figure 18

Digital Input 5 is functionally equivalent to Digital Input 1. Refer to B1.XX

B5.01 Digital Input 5 Destination (ICR, Preset: H1.05 [Reverse])

B5.02 Digital Input 5 Status (RO)

B5.03 Digital Input 5 Off Value (RW)

B5.04 Digital Input 5 On Value (RW)

B6: Frequency Input

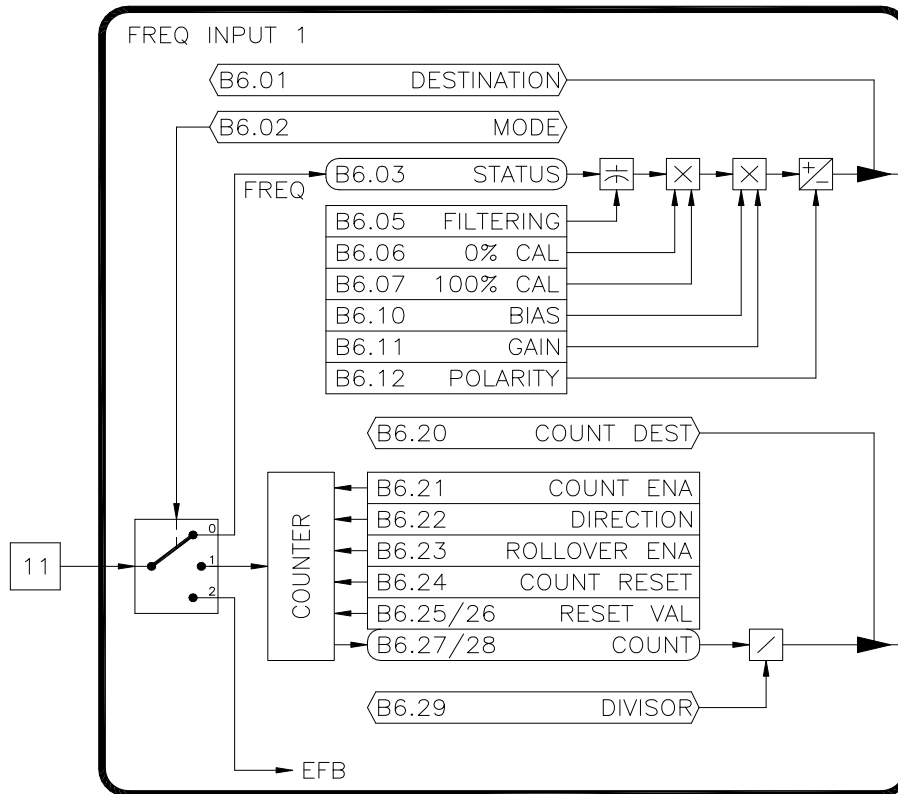


Figure 20

B6.01 Freq Input Destination (ICR, Preset: 00.00 [Not Set])

The frequency input can control (or write to) any R/W parameter in the drive. The destination parameter contains the tag of the parameter the input will control (i.e. the target parameter). Refer to Table 5 on page 24 for a list of commonly used functions.

B6.02 Freq Input Mode (ICR, Preset: Freq Input)

The frequency input can operate in either the **FREQ**, **COUNTER**, or **ENCODER** modes. In the frequency input mode, the input level is determined by the input frequency. The counter mode is used to count an incoming pulse train. The Encoder mode is used when a motor mounted encoder is used for speed feedback..

B6.03 Freq Input Status (RO)

Valid only when B6.02 equals **FREQ INPUT**. Displays the frequency input level at terminal 11 in Hertz.

B6.05 Freq Input Filtering (R/W, Preset: 0)

Sets the level of digital filtering applied to the input signal. The adjustment ranges from 0 (no filtering) to 15 (heavily filtered).

B6.06 Freq Input 0% Calibration (R/W, Preset: 0Hz)

Defines the minimum input frequency in Hertz. An input value below this level will be ignored. Range: 0..50,000Hz

B6.07 Freq Input 100% Calibration (R/W, Preset: 50000Hz)

Defines the maximum input frequency in Hertz. An input value above this level will be ignored. Range: 0..50,000Hz

B6.10 Freq Input Bias (R/W, Preset: 0.00)

Defines the value of the target parameter when the input signal is less than or equal to the 0%

Calibration. Note that the formatting of this parameter will change to match that of the target parameter. For example, if the target parameter is in percent, this parameter will be in percent. If the target parameter is True/False, this parameter will be True/False.

B6.11 Freq Input Gain (R/W, Preset: 100.00)

Defines the value of the target parameter when the input signal is greater than or equal to the 100% Calibration. Note that the formatting of this parameter will change to match that of the target parameter.

B6.12 Freq Input Polarity (R/W, Preset: Positive)

Defines the polarity of the target parameter. When set to **POSITIVE**, the target parameter will have a positive value. Likewise, when set to **NEGATIVE**, the target parameter will be negative.

B6.20 Counter Destination (ICR, Preset: 00.00 [Not Set])

The drive has a counter associated with the frequency input. This count value can control (or write to) any R/W parameter in the drive. The destination parameter contains the tag of the parameter the input will control (i.e. the target parameter).

B6.21 Counter Enable (R/W, Preset: Disabled)

The counter is enabled when set to **ENABLED**.

B6.22 Counter Direction (R/W, Preset: Up)

Controls the direction of the counter. When set to **UP**, each pulse on the input will cause the counter (B8.26/27) to increase. When set to **DOWN**, each pulse on the input will cause the counter to decrease.

B6.23 Rollover Enable (R/W, Preset: Disabled)

When **ENABLED**, the counter is allowed to rollover from maximum to minimum when counting up, or to rollover from minimum to maximum when counting down. If **DISABLED**, rollover is not allowed and the count value will stop and hold its value at the maximum or minimum.

B6.24 Counter Reset (R/W, Preset: Off)

Resets the counter (B8.26/27) to the Reset Value (B8.24/25) when **ON**.

B6.25 Reset Value Lo (R/W, Preset: 0)

B6.26 Reset Value Hi (R/W, Preset: 0)

The 32 bit counter will be preset to the value in these two registers when B8.23 is **ON**.

B6.27 Counter Lo (RO)

B6.28 Counter Hi (RO)

The 32 bit counter is split into two 16 bit sections (B8.28:B8.27). The counter has a maximum value of 4,294,967,295.

B6.29 Divisor (ICR, Preset: 1)

The 32 bit count value is divided by this value before being written to the target parameter.
Range: 0..65535

7.3 C: Analog Inputs

These parameters configure the drive's physical analog inputs.

C1: Analog Input 1

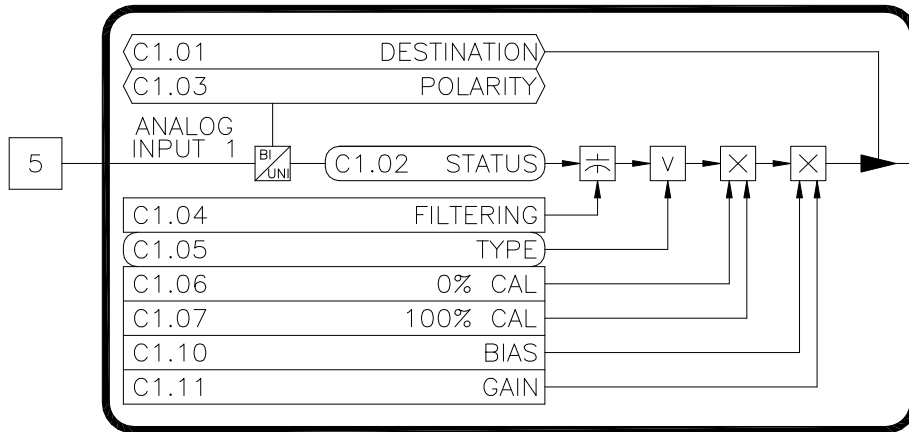


Figure 21

C1.01 Analog Input 1 Destination (ICR, Preset: I1.04 [Reference A])

Each of the analog inputs can control (or write to) any R/W parameter in the drive. The destination parameter contains the tag of the parameter the input will control (i.e. the target parameter). Refer to Table 5 for a list of commonly used functions.

Value	Function
G1.05	POSITIVE CURRENT LIMIT
G1.06	NEGATIVE CURRENT LIMIT
I1.04	REF A
I1.05	REF B
I1.06	REF C
I1.07	REF D
I1.08	JOG REF
I2.02	SETPOINT B
I2.04	SETPOINT C
I2.06	SETPOINT D
L1.13	AUX PID SETPOINT
L1.14	AUX PID FEEDBACK
L1.23	AUX PID SCALE
L2.07	DIA CALC: EXT DIA RATIO
L4.01	TENSION CALC: TENSION SET

Table 5: Common Analog & Freq Input Functions

C1.02 Analog Input 1 Status (RO)

Displays the raw analog to digital conversion value. Table 6 below lists the typical status values for common input voltage levels.

Signal Input	Status
+11V	2047
+10V	1861
+5V	930
0V	0
-5V	-931
-10V	-1862
-11V	-2048

Table 6: Analog Input Voltage Status Readings

C1.03 Analog Input 1 Polarity (ICR, Preset: Unipolar)

Configures the type of analog input signal used, either **UNIPOLAR** or **BIPOLAR**.

C1.04 Analog Input 1 Filtering (R/W, Preset: 0)

Sets the level of digital filtering applied to the input signal. The adjustment ranges from 0 (no filtering) to 15 (heavily filtered). Range: 0..15

C1.05 Analog Input 1 Type (RO, Preset: Voltage)

Configures the type of analog input signal used, either **VOLTAGE** or **CURRENT**. Analog Input 1 is a Voltage only input. Analog Input 2 can be configured.

C1.06 Analog Input 1 0% Calibration (R/W, Preset: 0)

Defines the minimum signal level in **UNIPOLAR** mode. Not used in the **BIPOLAR** mode. Refer to Figure 22. An input value below this level will be ignored. Range: 0..2047

C1.07 Analog Input 1 100% Calibration (R/W, Preset: 1862)

Defines the maximum raw signal level. An input value above this level will be ignored. Refer to Figure 22. Range: 0..4095

C1.10 Analog Input 1 Bias (R/W, Preset: 0.00)

Defines the value of the target parameter when the input signal is less than or equal to the 0% Calibration. Note that the formatting of this parameter will change to match that of the target parameter.

C1.11 Analog Input 1 Gain (R/W, Preset: 100.00)

Defines the value of the target parameter when the input signal is greater than or equal to the 100% Calibration. Note that the formatting of this parameter will change to match that of the target parameter.

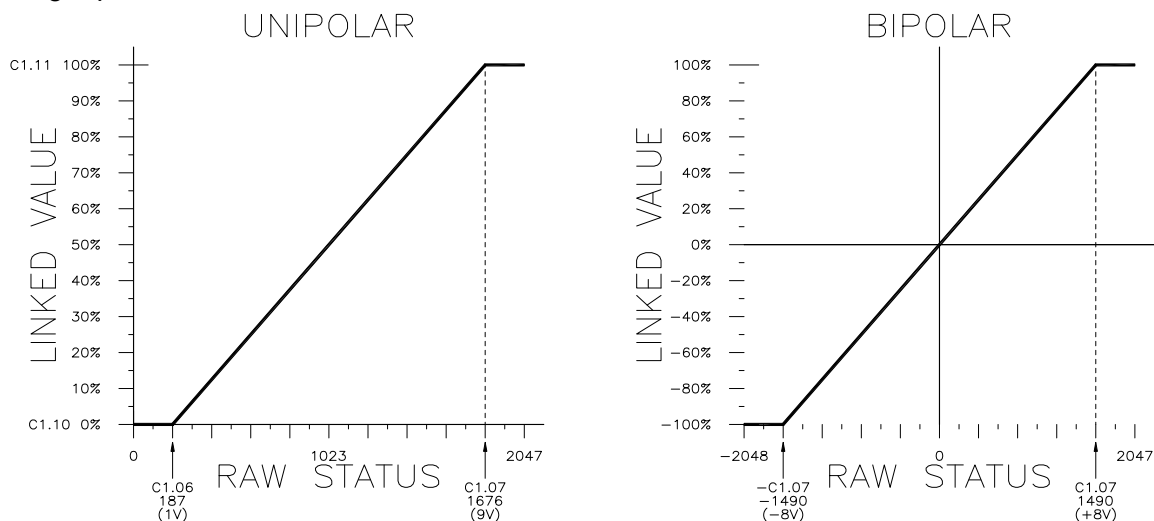


Figure 22: Analog Inputs

C2: Analog Input 2

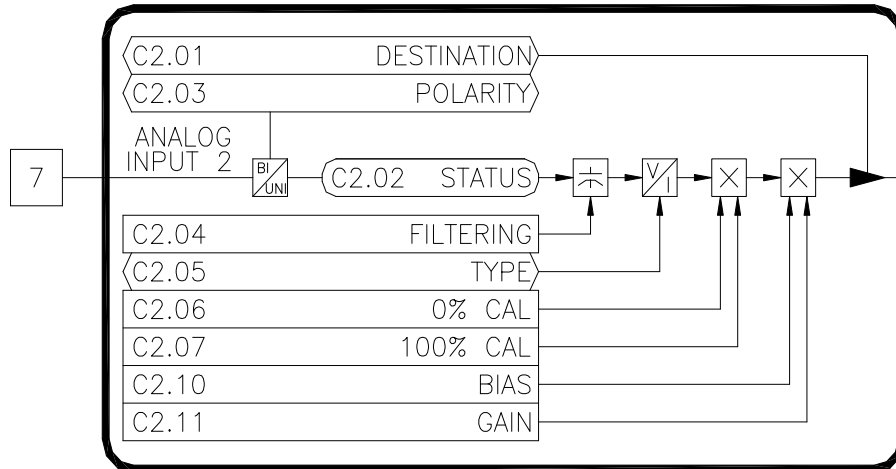


Figure 23

Analog Input 2 is functionally equivalent to Analog Input 1. Refer to C1.XX for details. The only exception is that this input can be configured for voltage or current. See parameters C2.02 and C2.05 below for differences.

C2.01 Analog Input 2 Destination (ICR, Preset: 00.00 [Not Set])

C2.02 Analog Input 2 Status (RO)

Displays the raw analog to digital conversion value. Table 6 above lists the typical status values for common input levels when in the voltage mode. Table 7 below lists the status values when used in the current mode.

Signal Input	Status
22mA	4095
20mA	3723
12mA	2234
4mA	745
0mA	0

Table 7: Analog Input 2 Current Status Readings

C2.03 Analog Input 2 Polarity (ICR, Preset: Unipolar)

C2.04 Analog Input 2 Filtering (R/W, Preset: 0)

C2.05 Analog Input 2 Type (ICR, Preset: Voltage)

Configures the type of analog input signal used, either **VOLTAGE** or **CURRENT**. Note that switch SW1 must also be set in the appropriate position.

C2.06 Analog Input 2 0% Calibration (R/W, Preset: 0)

C2.07 Analog Input 2 100% Calibration (R/W, Preset: 1862)

C2.10 Analog Input 2 Bias (R/W, Preset: 0.00)

C2.11 Analog Input 2 Gain (R/W, Preset: 100.00)

7.4 D: Digital Outputs

These parameters configure the drive's physical digital outputs (relay & frequency/digital).

D1: Relay Output 1

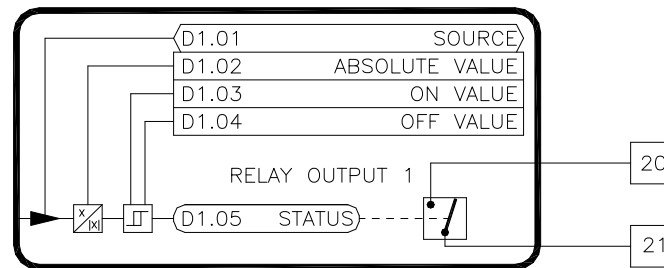


Figure 24

D1.01 Relay Output 1 Source (ICR, Preset: H1.16 [Drive Running])

The function of the relay output is configured by this parameter. Each output can be controlled by any parameter in the drive. The source parameter contains the tag of the parameter that will control the relay output. The source parameter's value is compared to the On Value and Off Value parameters (Dx.03 & Dx.04) to determine if the relay is energized or de-energized. Refer to Table 8 for a list of commonly used functions.

Value	Function
G3.05	IN FIELD ECONOMY
H1.13	DRIVE IN RUN MODE
H1.14	DRIVE IN JOG MODE
H1.16	DRIVE RUNNING (RUN or JOG)
J1.22	DRIVE RAMPING
K2.08	DRIVE FAULT
K2.10	DRIVE READY
S1.06	AT ZERO SPEED
S1.07	AT STANDSTILL

Table 8: Common Relay & Digital Output Functions

Note that when this output is used to control an armature contactor and digital input 1 is configured for E-STOP, jumper J3 should be set in the **ESTOP** position. This will enable a hardware circuit that will ensure Relay Out 1 de-energizes on an E-STOP condition. In all other cases, set jumper J3 to **NORMAL**.

D1.02 Relay Output 1 Absolute Value (R/W, Preset: Off)

When TRUE, the absolute value of the source parameter's value is taken before it is compared to the Dx.03 and Dx.04.

D1.03 Relay Output 1 On Value (R/W, Preset: On)

The relay will energize (turn on) when the source parameter's value is greater than or equal to this value. The limits and units of this parameter will change to match the limits and units of the source parameter.

D1.04 Relay Output 1 Off Value (R/W, Preset: Off)

The relay will de-energize (turn off) when the source parameter's value is less than or equal to this value. The limits and units of this parameter will change to match the limits and units of the source parameter.

D1.05 Relay Output 1 Status (RO)

Displays the status of the relay output.

D2: Relay Output 2

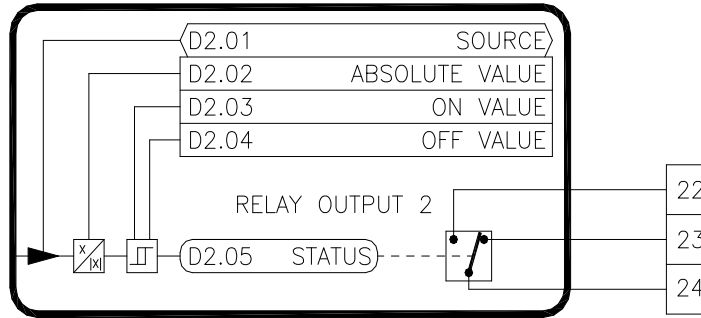


Figure 25

Relay Output 2 is functionally equivalent to Relay Output 1. Refer to D1.XX

D2.01 Relay Output 2 Source (ICR, Preset: S1.06 [Zero Speed])

D2.02 Relay Output 2 Absolute Value (R/W, Preset: Off)

D2.03 Relay Output 2 On Value (R/W, Preset: On)

D2.04 Relay Output 2 Off Value (R/W, Preset: Off)

D2.05 Relay Output 2 Status (RO)

7.5 E: Analog Outputs

These parameters configure the drive's physical analog outputs.

E1: Analog Output 1

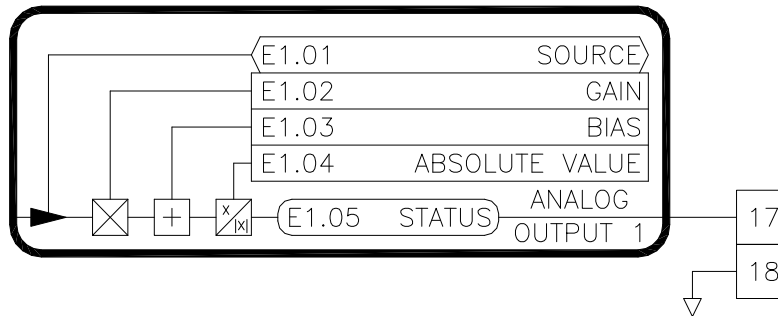


Figure 26

E1.01 Analog Output 1 Source (ICR, Preset: G2.18 [Filtered Velocity Feedback])

The function of this output is configured by this parameter. The output can be controlled by any parameter in the drive. The source parameter contains the tag of the parameter that will control the analog output level. Refer to Table 9 for a list of commonly used functions.

Value	Function
G1.13	MOTOR ARM CURRENT
G2.07	MOTOR ARM VOLTAGE
G2.18	MOTOR SPEED
G3.09	MOTOR FIELD CURRENT
G3.13	MOTOR FIELD VOLTAGE
I1.10	REFERENCE
J1.21	RAMP OUTPUT
L1.25	AUX PID OUTPUT

Table 9: Common Analog & Freq Output Functions

E1.02 Analog Output 1 Gain (R/W, Preset: 100.00%)

This adjustment is used to scale the output level. A gain of 100% with a source parameter value of 100% will yield maximum output level of 10V. Range: -300..300%

E1.03 Analog Output 1 Bias (R/W, Preset: 0.00%)

This adjustment is used to set a minimum output level. The percentage adjustment is based on the maximum output level (10V). Range: -300..300%

E1.04 Analog Output 1 Absolute Value (R/W, Preset: Off)

When **TRUE**, the absolute value is taken after the Bias and Gain have been applied to the source parameter's value. This effectively makes the output unipolar (positive only).

E1.05 Analog Output 1 Status (RO)

Displays the raw digital to analog output level. Refer to Table 10 for typical values.

Status	Voltage
+10V	2047
+5V	1023
0V	0
-5V	-1024
-10V	-2048

Table 10: Analog Output Status

E2: Analog Output 2

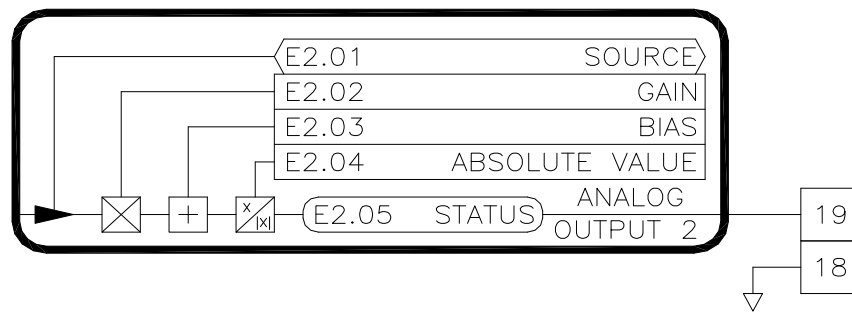


Figure 27

Analog Output 2 is functionally equivalent to Analog Output 1. Refer to E1.XX

E2.01 Analog Output 2 Source (ICR, Preset: G1.13 [Filtered Current Feedback])

E2.02 Analog Output 2 Gain (R/W, Preset: 100.00%)

E2.03 Analog Output 2 Bias (R/W, Preset: 0.00%)

E2.04 Analog Output 2 Absolute Value (R/W, Preset: Off)

E2.05 Analog Output 2 Status (RO)

7.6 F: Motor Data

F1: Motor Data

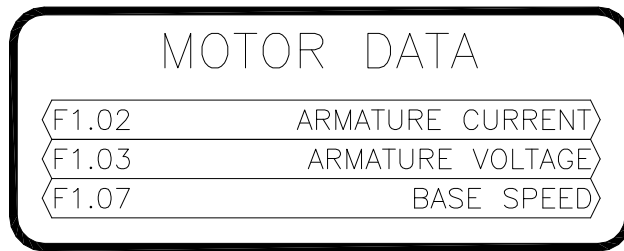


Figure 28

F1.02 Armature Current (ICR, Preset: 0A)

Enter the motor nameplate armature current rating.

F1.03 Armature Voltage (ICR, Preset: 0V)

Enter the motor nameplate armature voltage rating.

F1.07 Base Speed (ICR, Preset: 0 RPM)

Enter the motor nameplate base speed rating.

F2: Tachometer Data

This section is utilized only if a motor mounted tachometer is used for speed feedback.

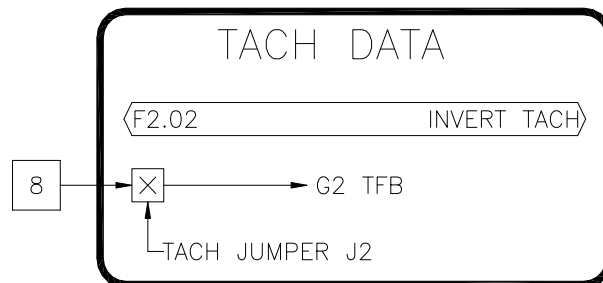


Figure 29

F2.02 Invert Tachometer (ICR, Preset: Off)

The tachometer feedback signal is polarity sensitive. The polarity is used to determine the direction of rotation of the motor. If the tachometer wires are reversed, this parameter can be used to invert (i.e. swap) the polarity of the tachometer signal without re-wiring.

F3: Encoder Data

This section is utilized only if a motor mounted encoder is used for speed feedback. Parameter B6.02 should also be set to EFB.

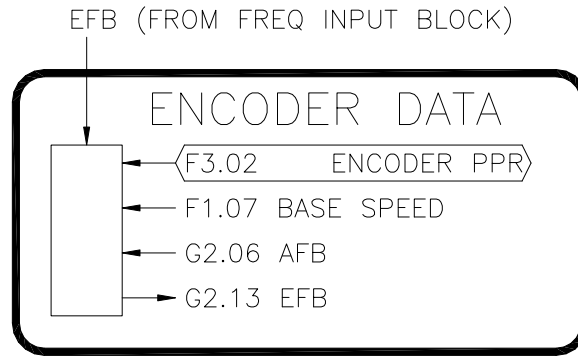


Figure 30

F3.02 Encoder Pulses/Rev (ICR, Preset: 1024)

Enter the number of pulses produced by the encoder in one revolution.

7.7 G: Control Loops

G1: Current Loop

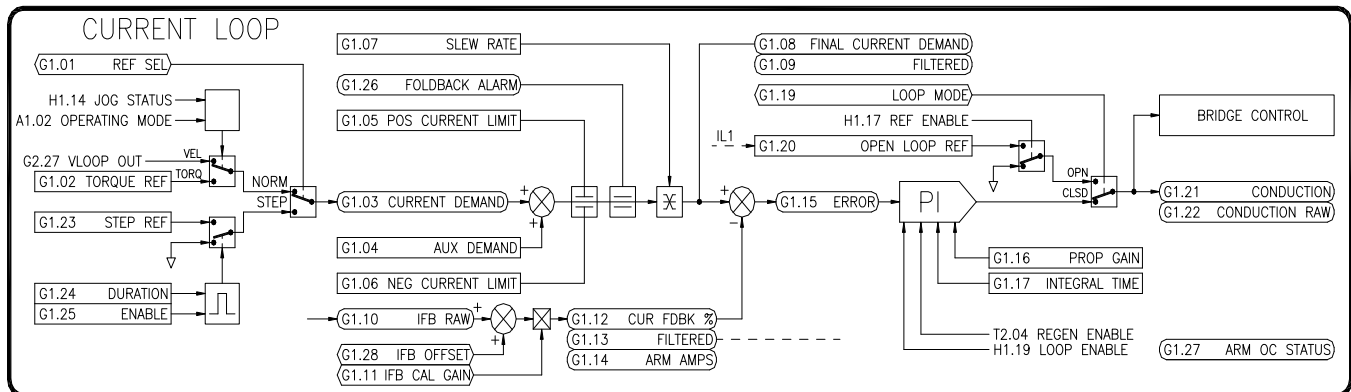


Figure 31

G1.01 Reference Select (ICR, Preset: Normal)

Selects the reference source for the loop. This parameter should always be set to **NORMAL** except when performing a step response loop tuning sequence.

G1.02 Torque Reference (R/W, Preset: 0.00%)

This is the current loop's reference when A1.02 is set to **TORQUE** mode. In the factory preset configuration, the Ramp 1 Output (J1.21) is linked to this parameter. Range: -150..150%

G1.03 Current Demand (RO)

This is the current loop's demand signal. It reflects the level of current that is demanded from either the Velocity Loop or the Torque Reference.

G1.04 Aux Demand (R/W, Preset: 0.00%)

An additional current demand signal can be summed with the G1.03. This parameter is mainly used in engineered applications. Range: -150..150%

G1.05 Positive Current Limit (R/W, Preset: 150.00%)

This parameter sets the maximum level of positive current that can be demanded. Positive current is used when the drive is motoring in the forward direction and regenerating in the reverse direction. Range: 0..150%

G1.06 Negative Current Limit (R/W, Preset: 150.00%)

This parameter sets the maximum level of negative current that can be demanded. Negative current is used when the drive is motoring in the reverse direction and regenerating in the forward direction. Range: 0..150%

G1.08 Final Current Demand (RO)

This parameter is the result of the summation of G1.03 and G1.04 after all of the current limits, foldback, and slew rate limits are applied.

G1.09 Filtered Final I Demand (RO)

A filtered version of G1.08.

G1.10 Current FB Raw (RO)

This is the raw analog to digital conversion value of the armature current feedback signal.

G1.11 Current FB Cal Gain (R/W, Preset: Varies by drive, typically 100%)

This is a calibration adjustment that is set at the factory. Customer adjustment is typically not required. Range: 90..110%

G1.12 Current Feedback (RO)

This status parameter indicates the level of armature current flowing in the motor. The reading is a percentage of F1.02.

G1.13 Filtered Current Feedback (RO)

A filtered version of G1.12.

G1.14 Armature Amps (RO)

G1.13 expressed in amps.

G1.15 Current Error (RO)

The difference between the final current demand (G1.08) and the current feedback (G1.12). This signal is the input to the PI loop.

G1.16 Current Prop Gain (R/W, Preset: 2.30)

Sets the loop response. Increasing the gain improves the response of the drive but can also increase overshoot. Range: 0..15

G1.17 Current Integral Time (R/W, Preset: 0.164 Secs)

Sets the loop response. Decreasing the integral time improves the response of the drive. Setting it too low can cause oscillations in the current. Range: 0.001..30 Secs

G1.19 Current Loop Mode (ICR, Preset: Closed Loop)

Diagnostic setting. Normally this parameter will always be in the **CLOSED LOOP** mode. When in **OPEN LOOP** mode, the current loop is bypassed and G1.20 controls the conduction angle of the armature SCRs.

G1.20 Open Loop Reference (R/W, Preset: 0.00%)

Diagnostic setting. When G1.19 is in the OPEN LOOP mode, this value sets the conduction angle. In the factory preset configuration, the Ramp 1 Output is linked to this parameter. Range: 0..100%

G1.21 Conduction (RO)

This is the output of the current loop. It is an input to the trigger board armature control.

G1.22 Conduction Raw (RO)

The raw conduction value.

G1.23 Step Reference (R/W, Preset: 0.00%)

Used only when G1.01 is set to **STEP**. Sets the level of current demand during a step level response test. Range: -150..150%

G1.24 Step Duration (R/W, Preset: 0.200 Secs)

Used only when G1.01 is set to **STEP**. Sets the amount of time in seconds that G1.22 is applied during the step level response test. Range: 0..10 Secs

G1.25 Step Enable (R/W, Preset: Off)

Used only when G1.01 is set to **STEP**. When set to **ON**, G1.22 is applied to G1.03 for the amount of time set by G1.23. The value then automatically returns to **OFF**.

G1.26 Armature Foldback Alarm (RO)

In the factory preset configuration, the drive can provide up to 150% of the nameplate motor armature current for a programmable time (see K1.11). After the drive has been producing current over 105% for this amount of time, a Foldback Alarm is generated (indicated by this parameter being **ON**). When the Foldback Alarm is **ON**, the final current demand is limited to 110%. If the armature current falls below the 105% level, the Foldback Alarm is cleared and the timer resets.

G1.27 Armature Over Current Status (RO)

The drive can continue to operate while a Foldback Alarm is active for K1.12 seconds. After the over current timer expires, this parameter will momentarily be set to **ON** and an Over Current fault will be generated.

G1.28 Current Feedback Offset (ICR, Preset: 0)

This is a calibration adjustment that is set at the factory. Customer adjustment is typically not required. Range: -200..200.

G2: Velocity Loop

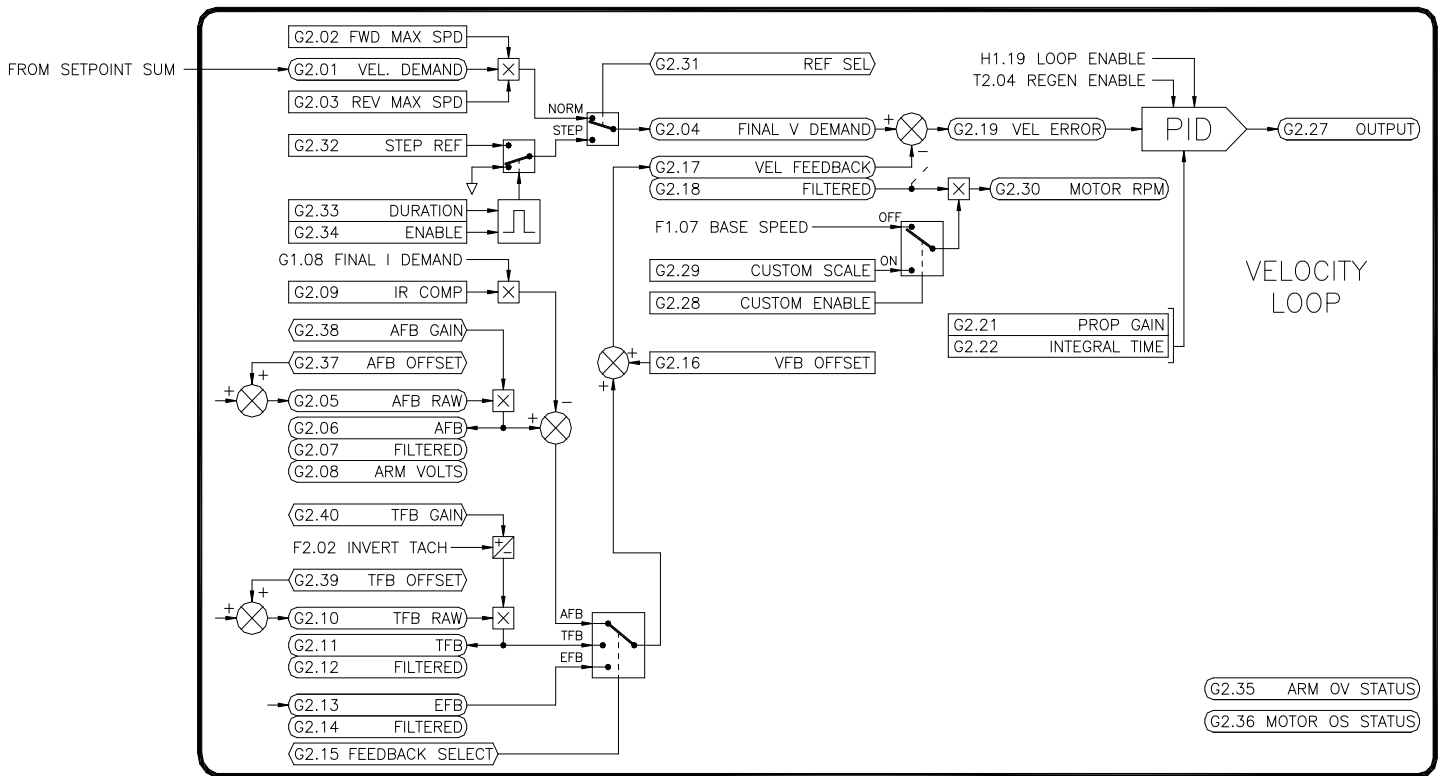


Figure 32

G2.01 Velocity Demand (RO)

This value is the summation of the setpoints in the Setpoint Sum (I2) block. It serves as the initial reference for the velocity (or speed) loop.

G2.02 Forward Max Speed Scale (R/W, Preset: 100.00%)

This parameter allows scaling of the Velocity Demand (G2.01). This parameter is only used when G2.01 is positive. Range: 0..105%

G2.03 Reverse Max Speed Scale (R/W, Preset: 100.00%)

This parameter allows scaling of the Velocity Demand (G2.01). This parameter is only used when G2.01 is negative. Range: 0..105%

G2.04 Final Velocity Demand (RO)

This parameter is the result of the scaling of G2.01 by G2.02 and G2.03 when Reference Select (G2.29) is set to NORMAL.

G2.05 Armature VFB Raw (RO)

This is the raw analog to digital conversion value of the armature voltage feedback signal.

G2.06 Armature VFB (RO)

This status parameter indicates the level of armature voltage on the motor. The reading is a percentage of F1.03.

G2.07 Armature VFB Filter (RO)

Filtered version of G2.06.

G2.08 Armature Volts (RO)

G2.07 expressed in volts.

G2.09 I.R. Comp (R/W)

Internal Resistance losses in the motor armature can cause decreased speed regulation on loaded motors when using armature voltage as the velocity feedback. The IR Comp adjustment

can be used to increase the speed regulation by summing a small amount of negative Current Feedback with the Armature Voltage Feedback. Range: 0..30.00%

G2.10 Tachometer FB Raw (RO)

This is the raw analog to digital conversion value of the tachometer voltage feedback signal.

G2.11 Tachometer Feedback (RO)

This status parameter indicates the level of tachometer voltage feedback. The reading is a percentage of the maximum tachometer voltage programmed via control board jumpers J1-J3.

G2.12 Tachometer Feedback Filtered (RO)

Filtered version of G2.11.

G2.13 Encoder Feedback (RO)

This status parameter indicates the level of encoder feedback. The reading is a percentage of the maximum encoder frequency calculated from F1.07 (Base Speed) or F1.08 (Extended Speed) and F3.02 (Encoder PPR).

G2.14 Encoder Feedback Filtered (RO)

Filtered version of G2.13.

G2.15 Feedback Select (ICR, Preset: Armature)

Selects the source of velocity (speed) feedback. **ARMATURE** uses the motor voltage as feedback. **TACHOMETER** uses a motor mounted tachometer (tachgenerator). **ENCODER** uses a motor mounted pulse generator. **TACH-JOG IN ARM** uses a tachometer in run mode, but uses armature while jogging. **ENCODER-JOG IN ARM** uses an encoder in run mode, but uses armature while jogging.

G2.16 VFB Offset (R/W, Preset: 0.00%)

This parameter allows any offset in the velocity feedback circuit to be zeroed. Proper adjustment should yield 0.00% at G2.18 when the motor is not turning. Range: -10..+10%

G2.17 Velocity Feedback (RO)

Status parameter that displays the level feedback selected by G2.15. This is the motor speed expressed as a percentage of either F1.07 (Base Speed) or F1.08 (Extended Speed).

G2.18 Velocity Feedback Filtered (RO)

Filtered version of G2.18

G2.19 Velocity Error (RO)

The difference between the final velocity demand (G2.04) and the velocity feedback (G2.17). This signal is the input to the PI loop.

G2.21 Velocity Prop Gain (R/W, Preset: 9.000)

Sets the loop response. Increasing the gain improves the response of the drive but can also increase overshoot. Range: 0..20

G2.22 Velocity Integral Time (R/W, Preset: 0.164 Secs)

Sets the loop response. Decreasing the integral time improves the response of the drive. Setting it too low can cause oscillations in the motor speed. Range: 0..30 Secs

G2.23 Velocity Derivative Gain (R/W, Preset: 0.000)

Sets the loop response. Increasing the derivative gain improves the response of the drive. Setting it too high can cause oscillations in motor speed. Range: 0..30

G2.27 Velocity Loop Output (RO)

The output of the velocity loop that serves as the input to the current loop.

G2.28 Custom Scale Enable (R/W, Preset: Off)

Normally, the motor RPM readout (G2.30) is calculated from the filtered velocity feedback (G2.18) and either the Base Speed (F1.07) or Extended Speed (F1.08) settings. In some cases, the displayed Motor RPM (G2.28) may not be correct due to motor inconsistencies. When set to **ON**, a Custom Scale (G2.29) can be used so that the correct motor RPM is displayed.

G2.29 Custom Scale (R/W, Preset: 0 RPM)

When G2.28 is set to ON, the filtered velocity feedback is multiplied by this parameter to produce the Motor RPM (G2.30). Adjust this parameter until G2.28 reads the correct speed.

Range: 0..10,000 RPM

G2.30 Motor RPM (RO)

Displays the current motor speed in RPM. When G2.15 is set to **ARMATURE**, this readout should be considered an approximate speed. If the displayed value is incorrect, a custom scale can be used. See G2.28 and G2.29.

G2.31 Reference Select (ICR, Preset: Normal)

Selects the reference source for the loop. This parameter should always be set to **NORMAL** except when performing a step response loop tuning sequence.

G2.32 Step Reference (R/W, Preset: 0.00%)

Used only when G2.31 is set to **STEP**. Sets the level of current demand during a step level response test. Range: -100..100%

G2.33 Step Duration (R/W, Preset: 2 Secs)

Used only when G2.31 is set to **STEP**. Sets the amount of time in seconds that G2.32 is applied during the step level response test. Range: 0..30 Secs

G2.34 Step Enable (R/W, Preset: Off)

Used only when G2.31 is set to **STEP**. When set to **ON**, G2.32 is applied to the final velocity demand (G2.04) for the amount of time set by G2.33. The value then automatically returns to **OFF**.

G2.35 Armature OV Status (RO)

This status parameter has a value of **ON** when the motor voltage exceeds 120%. An overvoltage fault is generated when this occurs.

G2.36 Motor Overspeed Status (RO)

This status parameter is only valid when the G2.15 is set to **TACHOMETER** or **ENCODER**. This status parameter has a value of **ON** when the filtered velocity feedback (G2.18) is greater than the motor overspeed level (K1.13). An overspeed fault is generated when this occurs.

G2.37 Armature Voltage Offset (ICR, Preset: 0)

This is a calibration adjustment that is set at the factory. Customer adjustment is typically not required. Range: -100..100.

G2.38 Armature Voltage Gain (ICR, Preset: 100.00%)

This is a calibration adjustment that is set at the factory. Customer adjustment is typically not required. Range: 90.00..100.00%.

G2.39 Tachometer Offset (ICR, Preset: 0)

This is a calibration adjustment that is set at the factory. Customer adjustment is typically not required. Range: -100..100.

G2.40 Tachometer Gain (ICR, Preset: 0)

This is a calibration adjustment that is set at the factory. Customer adjustment is typically not required. Range: 0.00..300.00%.

H1: Start/Stop Logic

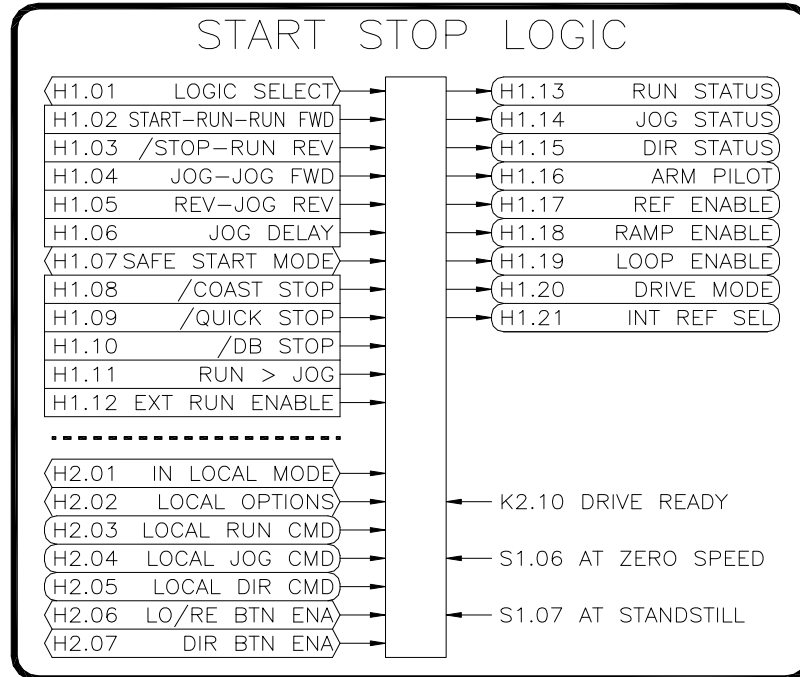


Figure 33

H1.01 Logic Select (ICR, Preset: Maintained Run/Dir)

Determines how the drive is started and stopped. There are four parameters that control the drive's mode and direction: H1.02-H1.05. Each of these parameters will have a different function depending upon the selection of H1.01. Typically, a digital input is linked to each of the H1.02-H1.05 parameters.

MOMENTARY (also known as 3 wire)

- H1.02 serves as the Start command
- H1.03 serves as the Ramp Stop command (active low)
- H1.04 serves as the Jog command
- H1.05 serves as the Reverse command

Drive will enter and stay in the run mode when H1.02 is momentarily **ON**. Drive will ramp to stop when H1.03 is momentarily **OFF**. Drive will Jog anytime H1.04 is **ON**. Reverse is selected when H1.05 is **ON**.

MAINTAINED 1 (RUN/DIR)

- H1.02 serves as the Run command
- H1.03 is not used
- H1.04 serves as the Jog command
- H1.05 serves as the Reverse command

Drive will enter the run mode as long as H1.02 is **ON**. Drive will ramp to stop when H1.02 is **OFF**. Drive will Jog anytime H1.04 is **ON**. Reverse is selected when H1.05 is **ON**.

MAINTAINED 2 (RUNF/RUNR)

- H1.02 serves as the Run Forward command
- H1.03 serves as the Run Reverse command
- H1.04 serves as the Jog Forward command
- H1.05 serves as the Jog Reverse command

In this mode, the drive will enter the indicated mode when the command is **ON**. The drive will ramp to stop when the input is **OFF**.

H1.02 Start-Run-Run Forward (R/W, Preset: Off)

Refer to H1.01 for functionality.

H1.03 /Stop-Run Reverse (R/W, Preset: Off)

Refer to H1.01 for functionality.

H1.04 Jog-Jog Forward (R/W, Preset: Off)

Refer to H1.01 for functionality.

H1.05 Rev-Jog Reverse (R/W, Preset: Off)

Refer to H1.01 for functionality.

H1.06 Jog Delay Time (R/W, Preset: 3.0 Secs)

This adjustment serves to extend the mechanical life of the armature contactor by reducing the number of mechanical operations in an application where a high rate of repeat "jogging" is performed. When the Jog button is pressed and then released, the reference is immediately clamped to stop the motor but the contactor is held energized for a time set by this parameter. Pressing the Jog button again within this "delay" period will cause the motor to immediately jog and will reset the delay.

Range: 0..10 Secs

H1.07 Safe Start Mode (ICR, Preset: Enabled)

The drive incorporates a safety feature that prevents the drive running if a run command is present during power up. While NOT recommended by Carotron, this feature can be disabled if other external safety logic is used.

H1.08 /Coast Stop (R/W, Preset: On)

This command is active low (i.e. when in the **OFF** state). When **OFF**, the drive clamps all the control loops and the motor will coast to a stop. The optional armature contactor does not de-energize until zero speed is reached. The drive will enter the Stop mode when the /Coast Stop command is removed (i.e. **ON**).

H1.09 /Quick Stop (R/W, Preset: On)

This command is active low (i.e. when in the **OFF** state). When **OFF**, the drive performs a current limit stop. It will try and stop the motor as fast as possible. The drive will enter the Stop mode when the /Quick Stop command is removed (i.e. **ON**).

H1.10 /DynBrk Stop (R/W, Preset: On)

This command is active low (i.e. when in the **OFF** state). When **OFF**, the drive de-energizes the optional armature contactor by opening Relay Output 1. The motor stopping time will be determined by the dynamic braking resistor. The drive will enter the Stop mode when the /DynBrk Stop command is removed (i.e. **ON**).

H1.11 Run Overrides Jog (R/W, Preset: Disabled)

When **DISABLED**, the drive is prevented from transitioning directly from the Jog mode to the Run mode. If **ENABLED** and a Run command (see H1.01) is received while jogging, the drive will transition to the Run mode.

H1.12 External Run Enable (RW)

This parameter is typically controlled by an E-STOP button connected to Digital Input 1. When **DISABLED**, the status displays E-STOP and the drive's armature output is disabled.

H1.13 Run Status (RO)

Status of drive. **ON** indicates the drive is in the run mode. Note that this does not include the jog mode.

H1.14 Jog Status (RO)

Status of drive. **ON** indicates the drive is in the jog mode.

H1.15 Direction Status (RO)

Indicates the commanded direction of the drive: **FWD** or **REV**. See H1.01 for details.

H1.16 Arm Pilot Status (RO)

Indicates the status of the armature pilot relay. When used, Relay Output 1 is typically linked to this parameter. **ON** Indicates the drive is in the run or jog modes.

H1.17 Reference Enable (RO)

Used as an input to the Setpoints block (I1). Its value is **DISABLED** while drive is ramping to a stop or stopped.

H1.18 Ramp Enable (RO)

Used as an input to the Ramp 1 block (J1). Its value is **DISABLED** during a quick stop.

H1.19 Loop Enable (RO)

Used as an input to the control loops. Its value is **ENABLED** while drive is running or jogging. Exception is when drive is At Standstill (S1.06).

H1.20 Drive Mode (RO)

Indicates the specific drive mode.

Numeric Value	Mode
0	STOP
1	RUN
2	RAMP STOP (FROM RUN)
3	JOG
4	RAMP STOP (FROM JOG)
5	JOG DELAY
6	QUICK STOP
7	COAST STOP
8	E-STOP
9	DB STOP
10	POWER UP
11	SAFE
12	CONTACTOR DELAY
13	FAULT

Table 11: Drive Modes

H1.21 Internal Ref Select (RO)

Used as an input to the Setpoints block (I1). Indicates which reference value is selected in the Setpoints block: **REF A-D**, **JOG REF**, **LOCAL REF**.

H2.01 In Local Mode (ICR, Preset: No)

Determines if the drive is in the Local mode of operation. The LOCAL/REMOTE key toggles this value.

H2.02 Local Options (ICR, Preset: LOCAL SS/LOCAL REF)

The drive can operate in one of three local modes.

LOCAL SS / LOCAL REF

Starting, stopping, & reference is controlled locally via the keypad.

LOCAL SS / REMOTE REF

Starting and stopping is controlled locally via the keypad. The drive uses a remote reference (i.e. REF A-D).

REMOTE SS / LOCAL REF

Starting and stopping is controlled remotely. The drive reference is controlled via the keypad.

H2.03 Local Run Command (RO)

ON indicates the drive is running in the local mode.

H2.04 Local Jog Command (RO)

ON indicates the drive is jogging in the local mode.

H2.05 Local Dir Command (RO)

Indicates the commanded direction in the local mode.

H2.06 Local/Remote Button (ICR, Preset: Enabled)

Enables/disables the LOCAL/REMOTE keypad button.

H2.07 Dir Button (ICR, Preset: Enabled)

Enables/disables the direction selection on the keypad when in the local mode. This parameter is valid only on regenerative models (see T1.07).

7.9 I: Setpoints

I1: Setpoints

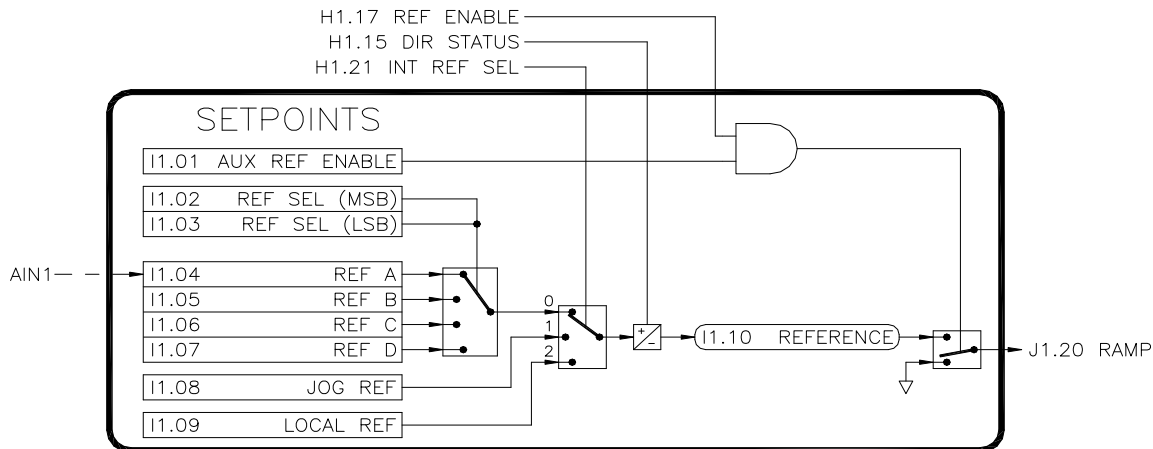


Figure 34

I1.01 Aux Reference Enable (R/W, Preset: Enabled)

Both H1.17 and this parameter must be ENABLED in order for the selected reference to be passed to the Ramp 1 block (J1). When used, this parameter is often linked from a digital input to confirm the armature contactor has closed.

I1.02 Reference Select (MSB) (R/W, Preset: Off)

I1.03 Reference Select (LSB) (R/W, Preset: Off)

The Reference Select parameters select between 4 internal references. I1.02 is the Most Significant Bit (MSB) and I1.03 is the Least Significant Bit (LSB). The table below shows the 4 input combinations used to select the different references.

I1.02	I1.03	Reference
OFF	OFF	Reference A (I1.04)
OFF	ON	Reference B (I1.05)
ON	OFF	Reference C (I1.06)
ON	ON	Reference D (I1.07)

Table 12: Reference Select

I1.04 Reference A (R/W, Preset: 0.00%)

I1.05 Reference B (R/W, Preset: 10.00%)

I1.06 Reference C (R/W, Preset: 15.00%)

I1.07 Reference D (R/W, Preset: 20.00%)

One of these four values serves as the reference when the drive is in the run mode. I1.02 & I1.03 determine which value is selected. In the factory preset configuration, the Reference A value is controlled by Analog Input 1. Range: -300..300%

I1.08 Jog Reference (R/W, Preset: 5.00%)

This value serves as the speed reference when the drive is in the jog mode. Range: -300..300%

I1.09 Local Reference (R/W, Preset: 0.00%)

This value serves as the speed reference when the drive is in the local mode. See H2.02 for exceptions. Typically, this parameter value is edited by pressing the ENTER key when the DM01 screen is displayed and the drive is in LOCAL mode. Range: -300..300%

I1.10 Reference (RO)

This parameter indicates the value of the selected reference.

I2. Setpoint Sum

This block sums four setpoints together. The result is the Velocity Demand (G2.01) signal for the Velocity Loop. Each of the four setpoints has a multiplier.

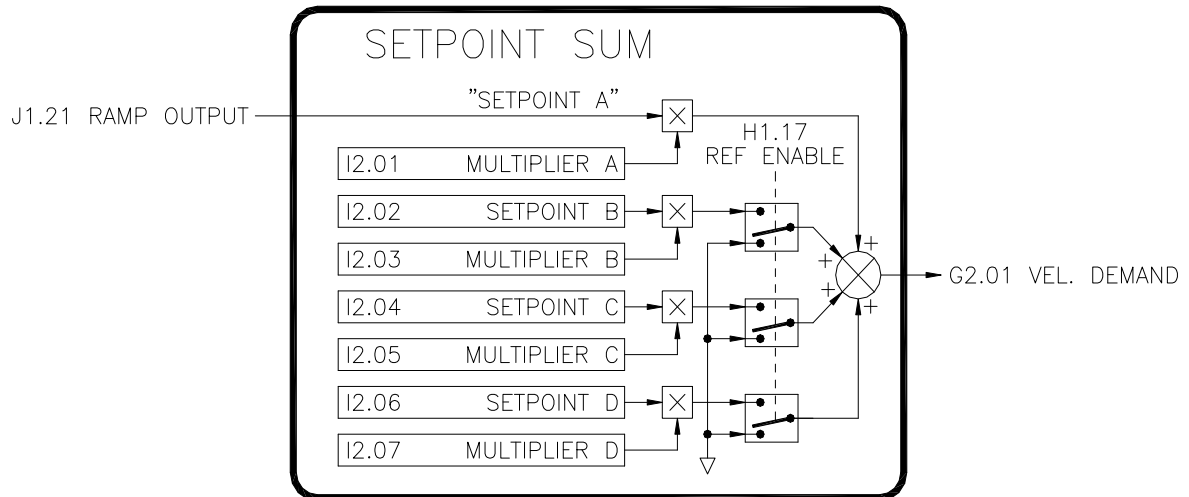


Figure 35

I2.01 Multiplier A (R/W, Preset: 100.00%)

Multiplier for Ramp Output signal. Range: -300..300%

I2.02 Setpoint B (R/W, Preset: 0.00%)

This value is summed with the drive's reference (via the Ramp 1 block). Range: -300..300%

I2.03 Multiplier B (R/W, Preset: 100.00%)

Multiplier for Setpoint B. Range: -300..300%

I2.04 Setpoint C (R/W, Preset: 0.00%)

Refer to I2.02. Range: -300..300%

I2.05 Multiplier C (R/W, Preset: 100.00%)

Refer to I2.03. Range: -300..300%

I2.06 Setpoint D (R/W, Preset: 0.00%)

Refer to I2.02. Range: -300..300%

I2.07 Multiplier D (R/W, Preset: 100.00%)

Refer to I2.03. Range: -300..300%

7.10 J: Ramps

J1: Ramp 1

The Ramp 1 block takes the reference output from the Setpoints block and applies a ramp rate to the signal. The ramped reference is an input to the Setpoint Sum block. Parameters J1.01-J1.04 set the linear acceleration and deceleration times. A positive reference is considered to be in the forward direction and a negative reference is considered reverse. Parameters J1.05-J1.08 set the "S Curve" characteristics. The ramp block has two sets of ramp parameters designated A and B. Ramp Select (J1.17) is used to select which set is used. In the factory preset configuration, the A set is used in the run mode and the B set is used in the jog mode.

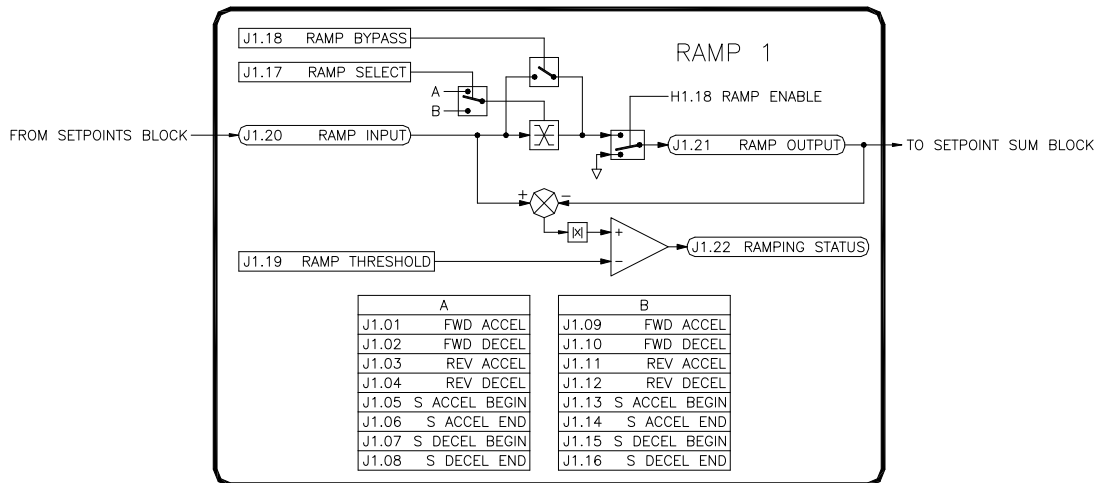


Figure 36

J1.01 Fwd Accel Time A (R/W, Preset: 5.0 Secs)

Defines the time that it takes for the reference to increase from 0.00% to +100.00%.
Range: 0.1..600 Secs

J1.02 Fwd Decel Time A (R/W, Preset: 5.0 Secs)

Defines the time that it takes for the reference to decrease from +100.00% to 0.00%.
Range: 0.1..600 Secs

J1.03 Rev Accel Time A (R/W, Preset: 5.0 Secs)

Defines the time that it takes for the reference to decrease from 0.00% to -100.00%. Valid only for regenerative model drives. Range: 0.1..600 Secs

J1.04 Rev Decel Time A (R/W, Preset: 5.0 Secs)

Defines the time that it takes for the reference to decrease from -100.00% to 0.00%. Valid only for regenerative model drives. Range: 0.1..600 Secs

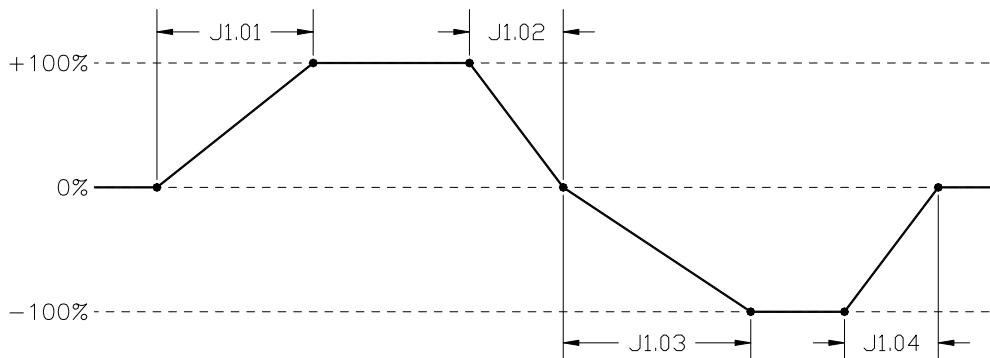


Figure 37

J1.05 S Accel Begin Time A (R/W, Preset: 0.0 Secs)

Defines the S Curve characteristic at the beginning of the acceleration ramp. Range: 0..10 Secs

J1.06 S Accel End Time A (R/W, Preset: 0.0 Secs)

Defines the S Curve characteristic at the ending the acceleration ramp. Range: 0..10 Secs

J1.07 S Decel Begin Time A (R/W, Preset: 0.0 Secs)

Defines the S Curve characteristic at the beginning of the deceleration ramp. Valid only for regenerative model drives. Range: 0..10 Secs

J1.08 S Decel End Time A (R/W, Preset: 0.0 Secs)

Defines the S Curve characteristic at the ending the deceleration ramp. Valid only for regenerative model drives. Range: 0..10 Secs

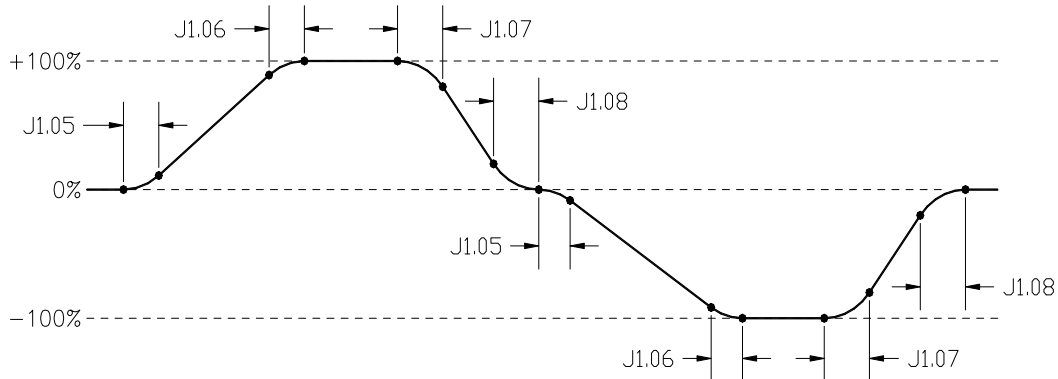


Figure 38

J1.09 Fwd Accel Time B (R/W, Preset: 1.0 Secs)

J1.10 Fwd Decel Time B (R/W, Preset: 1.0 Secs)

J1.11 Rev Accel Time B (R/W, Preset: 1.0 Secs)

J1.12 Rev Decel Time B (R/W, Preset: 1.0 Secs)

J1.13 S Accel Begin Time B (R/W, Preset: 0.0 Secs)

J1.14 S Accel End Time B (R/W, Preset: 0.0 Secs)

J1.15 S Decel Begin Time B (R/W, Preset: 0.0 Secs)

J1.16 S Decel End Time B (R/W, Preset: 0.0 Secs)

Parameters J1.09-J1.16 are used when Ramp Select (J1.17) is set to B. Otherwise, parameters J1.01-J1.08 are used.

J1.17 Ramp Select (R/W, Preset: A)

Determines which ramp parameters are used. When **A** is selected, parameters J1.01-J1.08 are used. When **B** is selected, parameters J1.09-J1.16 are used.

J1.18 Ramp Bypass (R/W, Preset: Off)

When **ON**, the ramp is bypassed and the Ramp Output (J1.21) is equal to the Ramp Input (J1.20).

J1.19 Ramp Threshold (R/W, Preset: 1.00%)

The block compares the input to the output to determine if the ramp is active. The Ramp Threshold sets how much difference between the input and output is required for the ramp to be considered active. Range: 0..100%

J1.20 Ramp Input (RO)

The input to the ramp block. When the drive is running, this parameter will be equal to the reference (I1.10). When stopped or ramping to stop, this parameter will have a value of 0%.

J1.21 Ramp Output (RO)

The output to the block. The Ramp Output (J1.21) will increase or decrease its value until it is equal to the Ramp Input (J1.20). The amount of time for it to change is determined by the Accel/Decel parameters.

J1.22 Ramping Status (RO)

Indicates whether the Ramp Output (J1.21) is increasing or decreasing to the value of the Ramp Input (J1.20).

J2: Ramp 2

The Ramp 2 block is very similar to the Ramp 1 block. It can be used for custom applications.

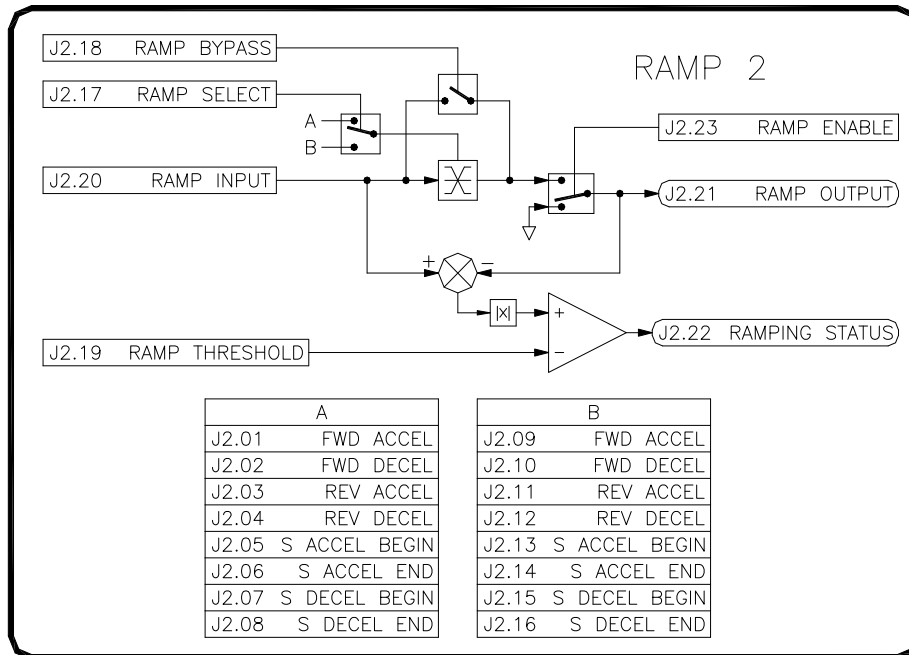


Figure 39

J2.01 Fwd Accel Time A (R/W, Preset: 5.0 Secs)

Defines the time that it takes for the ramp output to increase from 0.00% to +100.00%.
Range: 0.1..600 Secs

J2.02 Fwd Decel Time A (R/W, Preset: 5.0 Secs)

Defines the time that it takes for the ramp output to decrease from +100.00% to 0.00%.
Range: 0.1..600 Secs

J2.03 Rev Accel Time A (R/W, Preset: 5.0 Secs)

Defines the time that it takes for the ramp output to decrease from 0.00% to -100.00%.
Range: 0.1..600 Secs

J2.04 Rev Decel Time A (R/W, Preset: 5.0 Secs)

Defines the time that it takes for the ramp output to decrease from -100.00% to 0.00%.
Range: 0.1..600 Secs

J2.05 S Accel Begin Time A (R/W, Preset: 0.0 Secs)

Defines the S Curve characteristic at the beginning of the acceleration ramp. Range: 0..10 Secs

J2.06 S Accel End Time A (R/W, Preset: 0.0 Secs)

Defines the S Curve characteristic at the ending the acceleration ramp. Range: 0..10 Secs

J2.07 S Decel Begin Time A (R/W, Preset: 0.0 Secs)

Defines the S Curve characteristic at the beginning of the deceleration ramp. Range: 0..10 Secs

J2.08 S Decel End Time A (R/W, Preset: 0.0 Secs)

Defines the S Curve characteristic at the ending the deceleration ramp. Range: 0..10 Secs

J2.09 Fwd Accel Time B (R/W, Preset: 1.0 Secs)

J2.10 Fwd Decel Time B (R/W, Preset: 1.0 Secs)

J2.11 Rev Accel Time B (R/W, Preset: 1.0 Secs)

J2.12 Rev Decel Time B (R/W, Preset: 1.0 Secs)

J2.13 S Accel Begin Time B (R/W, Preset: 0.0 Secs)

J2.14 S Accel End Time B (R/W, Preset: 0.0 Secs)

J2.15 S Decel Begin Time B (R/W, Preset: 0.0 Secs)

J2.16 S Decel End Time B (R/W, Preset: 0.0 Secs)

Parameters J2.09-J2.16 are used when Ramp Select (J2.17) is set to B. Otherwise, parameters J2.01-J2.08 are used.

J2.17 Ramp Select (R/W, Preset: A)

Determines which ramp parameters are used. When **A** is selected, parameters J2.01-J2.08 are used. When **B** is selected, parameters J2.09-J2.16 are used.

J2.18 Ramp Bypass (R/W, Preset: Off)

When **ON**, the ramp is bypassed and the Ramp Output (J2.21) is equal to the Ramp Input (J2.20).

J2.19 Ramp Threshold (R/W, Preset: 1.00%)

The block compares the input to the output to determine if the ramp is active. The Ramp Threshold sets how much difference between the input and output is required for the ramp to be considered active. Range: 0..100%

J2.20 Ramp Input (RO)

The input to the ramp block.

J2.21 Ramp Output (RO)

The output to the block. The Ramp Output (J2.21) will increase or decrease its value until it is equal to the Ramp Input (J2.20). The amount of time for it to change is determined by the Accel/Decel parameters.

J2.22 Ramping Status (RO)

Indicates whether the Ramp Output (J2.21) is increasing or decreasing to the value of the Ramp Input (J2.20).

J2.23 Ramp Enable (RW, Preset: Disable)

Enables/disables the ramp. When enabled, the Ramp Output (J2.21) will increase or decrease its value until it is equal to Ramp Input (J2.20). When disabled, the Ramp Output value holds its current value.

K1: Fault Options

FAULT OPTIONS	
K1.01	FEEDBACK LOSS ENABLE
K1.02	FEEDBACK LOSS LEVEL
K1.11	ARM I FOLDBACK TIME
K1.12	ARM OC TIME
K1.13	OVERSPEED LEVEL
K1.14	EXTERNAL FAULT
K1.15	EXT FAULT RESET
K1.16	S/W FAULT RESET
K1.17	KEYPAD DETECT ENA

Figure 40

K1.01 Feedback Loss Enable (R/W, Preset: Enabled)

Only used if G2.15 is set to **TACHOMETER** or **ENCODER**. In order to prevent excessive speed in a run away condition, the drive has the capability to detect the loss of a speed feedback signal. When detected, the drive will generate a Feedback Loss fault. Setting this parameter to **DISABLED** prevents this fault from occurring.

K1.02 Feedback Loss Level (R/W, Preset: 55.00%)

A feedback loss fault is generated if the conduction angle exceeds this level and the velocity feedback (G2.17) is below 2%.

Range: 0..100%

K1.11 Arm Curr Foldback Time (R/W, Preset: 15.0 Secs)

Defines the length of time the drive will allow the armature current to exceed 105% before the foldback alarm is generated. If the current drops below 105%, the timer will reset.

Range: 0..60 Secs

K1.12 Arm OC Time (R/W, Preset: 45.0 Secs)

Defines the length of time the drive will allow the armature current to exceed 105% before an over current fault is generated. If the current drops below 105%, the timer will reset.

Range: 0..240 Secs

K1.13 Motor Overspeed Level (R/W, Preset: 125.00%)

Only used if G2.15 is set to **TACHOMETER** or **ENCODER**. Defines the level of an over speed fault. The percentage adjustment is based on the velocity feedback (G2.17). Range: 0..125%

K1.14 External Fault (R/W, Preset: Off)

Typically a digital input is linked to this parameter. This allows an external signal to generate a drive fault. A value of **ON** generates the fault.

K1.15 External Fault Reset (R/W, Preset: Off)

In the factory preset configuration, digital input 7 is linked to this parameter. When this parameter has a value of **ON**, the drive will attempt to clear any fault that is present.

K1.16 Software Fault Reset (R/W, Preset: Off)

When this parameter has a value of **ON**, the drive will attempt to clear any fault that is present. It's value will automatically return to **OFF**. This parameter is typically used by an external controller via a communications channel.

K1.17 Keypad Disconnect Fault (R/W, Preset: Disabled)

When **ENABLED**, the drive will generate a keypad disconnected fault if/when the keypad is disconnected.

K2: Fault Status

FAULT STATUS	
K2.01	POWER ON RESET
K2.02	INT FAULT RESET
K2.03	ACTIVE FAULTS 1
K2.04	ACTIVE FAULTS 2
K2.05	LATCHED FAULTS 1
K2.06	LATCHED FAULTS 2
K2.07	FAULT
K2.08	DRIVE FAULTED
K2.10	DRIVE READY
K2.11	ACTIVE ALARMS 1
K2.12	ACTIVE ALARMS 2
K2.13	ALARM

K2.01 Power On Reset (RO)

The drive generates an internal reset by setting this parameter to **ON** after power is applied. After the reset expires, the value returns to **OFF**.

K2.02 Internal Fault Reset (RO)

This parameter is set to **ON** when the RESET button on the keypad is used to clear a fault. Its value automatically returns to **OFF**.

K2.03 Active Faults 1 (RO)

This parameter along with K2.04 indicate which faults are currently active. A '1' indicates the fault is active and a '0' indicates the fault is not active.

Figure 41

EEPROM Write		Undefined		Undefined		Motor Over Speed
EEPROM Read		External Fault		Undefined		Armature Over Voltage
Keypad Disconnect		Undefined		Undefined		Feedback Loss
Undefined		Undefined		Armature Over Current		Undefined
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0

Table 13: Faults 1

K2.04 Active Faults 2 (RO)

Refer to K2.03.

Undefined		Com C Timeout		Undefined
Undefined		Motor Data		Undefined
Undefined		Undefined		Undefined
Undefined		Undefined		Undefined
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0

Table 14: Faults 2

K2.05 Latched Faults 1 (RO)

This parameter along with K2.06 indicate which faults have latched. When a fault occurs, it may only be active momentarily. The drive latches faults so that they may be examined before being cleared. A '1' indicates the fault occurred and is latched. A fault reset will clear the '1' back to a '0' (assuming the fault is no longer active). Refer to Table 13.

K2.06 Latched Faults 2 (RO)

Refer to K2.05. Refer to Table 14.

K2.07 Fault Description (RO)

Indicates the current fault. If multiple faults are latched, the highest priority fault is displayed. Refer to page 90 for a list of faults and their descriptions.

K2.08 Drive Faulted (RO)

YES indicates if the drive is currently faulted.

K2.10 Drive Ready (RO)

YES indicates the drive is ready to run. The drive is considered ready to run when the Run Enable (H1.12) is in the ENABLED state and Drive Faulted (K2.08) is NO.

K2.11 Active Alarms 1 (RO)

This parameter indicates which alarms are currently active. A '1' indicates the alarm is active and a '0' indicates the alarm is not active.

Undefined	Undefined	Undefined	Undefined	-	Undefined	Undefined	Undefined	Undefined	-	Undefined	Undefined	Undefined	Com C Timeout	-	Undefined	Undefined	Foldback	EEPROM Write
0	0	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0	0	0

Table 15: Alarms 1

K2.12 Active Alarms 2 (RO)

This parameter is reserved and not currently used.

K2.13 Active Description (RO)

Indicates the current alarm. If multiple alarms are present, the highest priority alarm is displayed.

K3: Fault Log

K3.01 Most Recent Fault (RO)

K3.02 2nd Most Recent Fault (RO)

K3.03 3rd Most Recent Fault (RO)

K3.04 4th Most Recent Fault (RO)

K3.05 5th Most Recent Fault (RO)

K3.06 6th Most Recent Fault (RO)

K3.07 7th Most Recent Fault (RO)

K3.08 8th Most Recent Fault (RO)

K3.09 9th Most Recent Fault (RO)

K3.10 10th Most Recent Fault (RO)

The fault log keeps track of the last 10 faults. The newest fault is stored in K3.01. The oldest fault is stored in K3.10.

K3.11 Clear Fault Log (R/W, Preset: No)

Clears K3.01-K3.10 to 'NONE' when set to **YES**. The value automatically returns to **NO**.

FAULT LOG	
K3.01	MOST RECENT FAULT
K3.02	2ND MOST RECENT FAULT
K3.03	3RD MOST RECENT FAULT
K3.04	4TH MOST RECENT FAULT
K3.05	5TH MOST RECENT FAULT
K3.06	6TH MOST RECENT FAULT
K3.07	7TH MOST RECENT FAULT
K3.08	8TH MOST RECENT FAULT
K3.09	9TH MOST RECENT FAULT
K3.10	10TH MOST RECENT FAULT
K3.11	CLEAR FAULT LOG

Figure 42

K4: Fault Capture

The fault capture block captures the values of certain operating parameters when a fault occurs. The captured values can be used as a troubleshooting/diagnostic aid in determining the cause of the fault.

K4.01 Fault (RO)

A description of the fault.

K4.02 Armature Volts (RO)

The armature voltage level (G2.08) when the fault occurred.

K4.03 Armature Amps (RO)

The armature current level (G1.14) when the fault occurred.

K4.06 Reference (RO)

The reference level (I1.10) when the fault occurred.

K4.07 Ramp Output (RO)

The ramp output level (J1.21) when the fault occurred.

K4.08 Final Vel Demand (RO)

The final velocity demand level (G2.04) when the fault occurred.

K4.09 Velocity Feedback (RO)

The velocity feedback level (G2.17) when the fault occurred.

K4.10 Final Current Demand (RO)

The final armature current demand level (G1.08) when the fault occurred.

K4.11 Arm Current Feedback (RO)

The armature current feedback level (G1.12) when the fault occurred.

K4.12 Armature Conduction (RO)

The armature conduction level (G1.20) when the fault occurred.

K4.16 Drive Mode (RO)

The drive mode (H1.20) when the fault occurred.

K4.17 Clear Fault Capture (R/W, Preset: No)

When set to **YES**, clears parameters K4.01-K4.17. The value automatically resets to **NO**.

FAULT CAPTURE	
K4.01	FAULT
K4.02	ARMATURE VOLTS
K4.03	ARMATURE AMPS
K4.06	REFERENCE
K4.07	RAMP OUTPUT
K4.08	FINAL VELOCITY DEMAND
K4.09	VELOCITY FEEDBACK
K4.10	FINAL ARM CURRENT DEMAND
K4.11	ARM CURRENT FEEDBACK
K4.12	ARMATURE CONDUCTION
K4.16	DRIVE MODE
K4.17	CLEAR FAULT CAPTURE

Figure 43

7.12 L: Applications

L1: Aux PID Loop

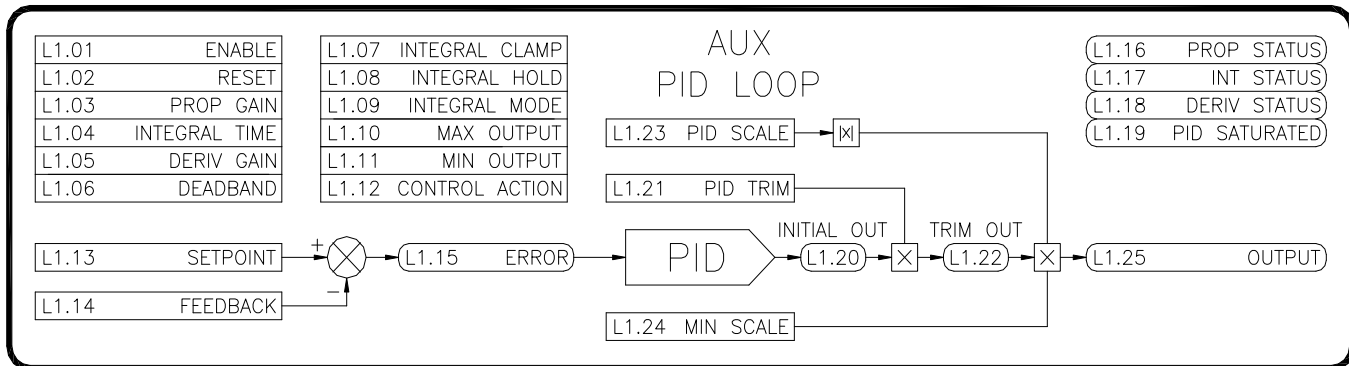


Figure 44

L1.01 PID Enable (R/W, Preset: Disabled)

Enables/disables the PID loop. The output (L1.25) is held at zero when **DISABLED**.

L1.02 PID Reset (R/W, Preset: Off)

Resets the PID loop. The output (L1.25) is held at zero when **ON**.

L1.03 Prop Gain (R/W, Preset: 5.00)

Sets the loop response. Increasing the gain improves the loop response but can also increase overshoot. Range: 0..100

L1.04 Integral Time (R/W, Preset: 10.000 Secs)

Sets the loop response. Decreasing the integral time improves the loop response. Setting it too low can cause oscillations. Range: 0.01..60 Secs

L1.05 Derivative Gain (R/W, Preset: 0.00)

Sets the loop response. Increasing the gain improves the response. Setting it too high can cause oscillations. Range: 0..600

L1.06 Deadband (R/W, Preset: 0.00%)

This adjustment is used to provide a window of tolerance in the error signal that the integral circuit will ignore. This is commonly used to ignore small dancer movements. Range: 0-30%

L1.07 Integral Clamp (R/W, Preset: Off)

When **ON**, the integral signal is clamped to zero in the PID loop, yielding proportional-derivative control only.

L1.08 Integral Hold (R/W, Preset: Off)

When **ON**, the integral signal is held at its current level.

L1.09 Integral Mode (R/W, Preset: Linear)

When set to **LINEAR**, the integral signal changes at a linear rate. It is not dependent on the magnitude of the error signal. When set to **CLASSICAL**, the integral signal is dependent on the magnitude of the error signal.

L1.10 Max Output (R/W, Preset: 100.00%)

Defines the upper limit for the initial PID output. Range: 0..+100%

L1.11 Min Output (R/W, Preset: 100.00%)

Defines the lower limit for the initial PID output. Range: 0..-100..0%

L1.12 Controller Action (R/W, Preset: ERR=SP-FB)

Determines how the error is calculated. The error is the difference between the Setpoint and Feedback parameters. This effectively determines the direction of correction that the PID loop provides. Available options are ERR=SP-FB or ERR=FB-SP.

L1.13 Setpoint (R/W, Preset: 0.00%)

The desired position on dancer systems or the desired tension on loadcell systems.
Range:0..100%

L1.14 Feedback (R/W, Preset: 0.00%)

The dancer feedback signal or loadcell feedback signal. This signal will typically come from one of the Analog Inputs. Range:0..100%

L1.15 Error (RO)

The difference between the Setpoint (L1.12) and the Feedback (L1.13) signals. The sign of the error is determined by Controller Action (L1.12).

L1.16 Prop Status (RO)

The individual proportional component of the PID Loop. This parameter is provided for aid in setup and tuning.

L1.17 Integral Status (RO)

The individual integral component of the PID Loop. This parameter is provided for aid in setup and tuning.

L1.18 Deriv Status (RO)

The individual derivative component of the PID Loop. This parameter is provided for aid in setup and tuning.

L1.19 PID Saturation Status (RO)

When ON, the PID output signal has saturated. This may indicate that the PID Trim (L1.21) may need to be increased. This parameter is provided for aid in setup and tuning.

L1.20 Initial Output (RO)

The initial output of the PID loop. This value is the sum of parameters L1.16-L1.18. The Max Output and Min Output parameters can limit this value.

L1.21 PID Trim (R/W, Preset: 10.00%)

A scale that is applied to L1.20 that produces L1.22. Typically this adjustment is used to reduce the operating range of the loop. Range:-100..100%

L1.22 Trim Output (RO)

The result of the Initial Output (L1.20) scaled by the PID Trim (L1.21).

L1.23 PID Scale (R/W, Preset: 100.00%)

In some applications, it is advantageous to scale the PID output to an external signal (such as line speed). This allows the loop to provide less correction at low speeds and more correction at higher speeds. When used, an external signal is typically linked to this parameter.
Range:-100..100%

L1.24 PID Min Scale (R/W, Preset: 10.00%)

Used in conjunction with L1.23. When an external signal is used to scale the PID output (see L1.23), it may be desirable to set a minimum scaling limit. This ensures the loop will always be able to provide an output even if PID Scale (L1.23) is zero. Range:0..100%

L1.25 PID Output (RO)

The final output of the PID loop. Typically, this value is linked to another parameter in the drive via an internal link.

L2: Diameter Calculator

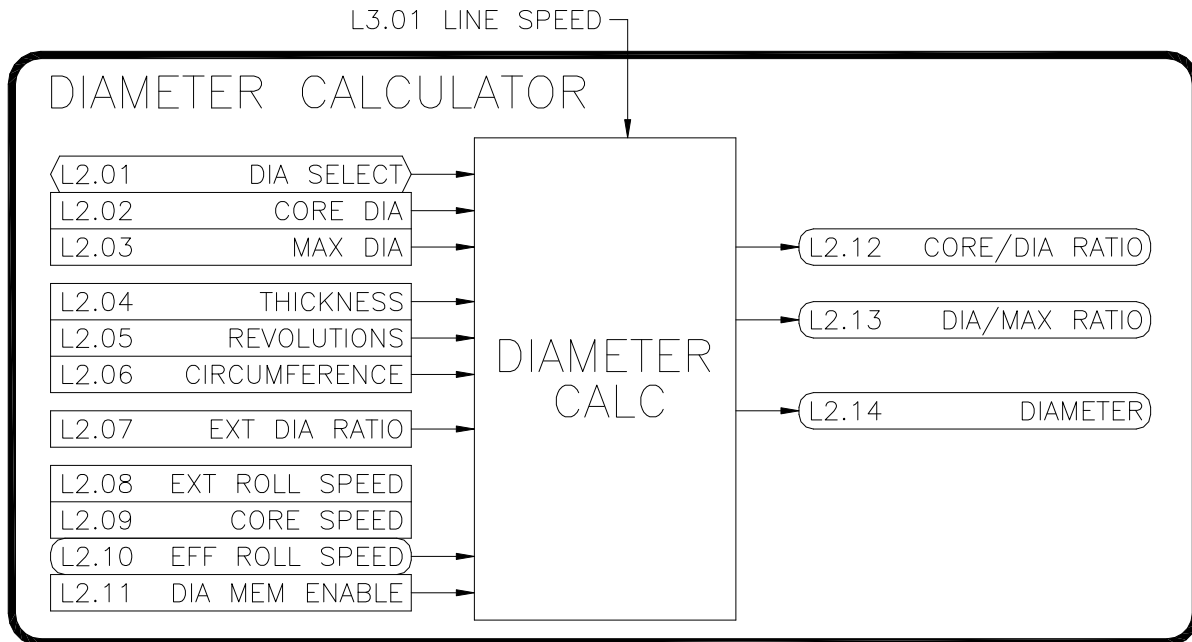


Figure 45

L2.01 Diameter Select (R/W, Preset: None)

Selects the method of diameter calculation.

NONE

The diameter calculator is disabled.

EXTERNAL

An external device measures the diameter (such as a sonic or a laser). The external device is connected to an analog or freq input. The input is linked to the External Diameter Ratio (L2.07).

ROLL REVOLUTIONS

An external sensor (proximity or encoder) is used to send a pulse train to the frequency input. The counter function is used to keep track of the number of winder/unwinder roll revolutions. This count is linked to L2.05. This count along with the Material Thickness (L2.04) is used to calculate the diameter.

LINE REVOLUTIONS

Similar to the ROLL REVOLUTIONS selection above. However, the sensor producing the pulse train is located on a line roller instead of the winder/unwinder roll. The Circumference (L2.06) of the line roller is also required along with the Material Thickness (L2.04) to calculate the diameter.

LINE/ROLL

This method uses Line Speed (L3.01) along with the Roll Speed (L2.08) to calculate the diameter. This method is only recommended for use when the drive is operating in the torque mode (A1.02).

L2.02 Core Diameter (R/W, Preset: 1.00")

Defines the minimum core diameter. Typically, if multiple size cores are used, the smallest size should be entered. Range: 0.01..600"

L2.03 Max Diameter (R/W, Preset: 10.00")

Defines the maximum roll diameter. Typically, if multiple sizes are used, the largest size should be entered. Range: 0.01..600"

L2.04 Thickness (R/W, Preset: 0.0001")

Used only when L2.01 is set to **ROLL REVOLUTIONS** or **LINE REVOLUTIONS**.

The actual thickness of the material being used should be entered here. If a range of material thicknesses are used, an average of the thickness should be used. Alternatively, an external controller (such as an HMI) could be used to change this value for different products.

Range: 0.0001..6"

L2.05 Revolutions (R/W, Preset: 0)

Used only when L2.01 is set to **ROLL REVOLUTIONS** or **LINE REVOLUTIONS**. Typically, either the frequency or encoder input blocks are linked to this parameter. For each revolution of the roll, this count should increase or decrease by 1. Range: 0..65535

L2.06 Circumference (R/W, Preset: 0.01")

Used only when L2.01 is set to **LINE REVOLUTIONS**. The circumference of the line roller that is producing the pulse train should be entered here. This parameter informs the diameter calculator how much material is added to or removed from the roll in one revolution. Range: 0..300"

L2.07 External Diameter (R/W, Preset: 0.00%)

Used only when L2.01 is set to **EXTERNAL**. Typically, an analog or frequency input is linked to this parameter. This signal should be scaled so a value of 0.00% represents an empty core (L2.02), and a value of 100% represents maximum diameter (L2.03). Range: 0..100%

L2.08 External Roll Speed (R/W, Preset: 0.00%)

Used only when L2.01 is set to **LINE/ROLL**. Typically, the Filtered Velocity Feedback (G2.18) is linked to this parameter. This value informs the diameter calculator of the speed of the winder/unwinder roll. Range: -100..100%

L2.09 Core Speed (R/W, Preset: 100.00%)

Used only when L2.01 is set to **LINE/ROLL**. This parameter defines the maximum level of L2.08. The maximum level is typically obtained when an empty core is loaded and speed matched to the line that is running at maximum desired speed. Range: 0..100%

L2.10 Effective Roll Speed (RO)

Used only when L2.01 is set to **LINE/ROLL**. L2.08 and L2.09 are used to calculate this value. It should have a value of 0% when the roll is stopped, and a value of 100% when an empty core is speed matched to the line.

L2.11 Diameter Memory (R/W, Preset: Disabled)

Used only when L2.01 is set to **LINE/ROLL**. A diameter memory function is provided to maintain speed based diameter levels during stop (when the Line Speed and External Roll Speed signals are at 0.00%). When **ENABLED**, memory function does not allow the Diameter signal to decrease in value. When **DISABLED**, the memory circuit is not used and the calculated diameter is based on the current Line Speed and Roll Speed values.

L2.12 Core/Dia Ratio (RO)

The ratio of the core diameter (L2.02) to the calculated diameter (L2.14).

L2.13 Dia/Max Ratio (RO)

The ratio of the calculated diameter (L2.14) to the maximum diameter (L2.03).

L2.14 Diameter (RO)

The calculated roll diameter.

L3: Roll Speed Calculator

A problem encountered in center driven take-up and let-off applications is the nonlinear relationship between the diameter of a roll and the motor speed required to maintain constant surface speed of the roll during diameter increase or decrease. A plot of this relationship shows a hyperbolic curve. Refer to Figure 48. When the line speed and roll diameter values are known, the required roll speed can be calculated. The rate of material take-up or pay-out from a center driven winder or unwinder would be held constant during roll diameter changes. The line speed signal typically comes from a tachometer, encoder, or an output from the line drive. The diameter information can be obtained through a number of different methods (see L2.01). The scaled line speed is divided by the scaled diameter signal to generate the center drive speed reference. Depending on required system response, a dancer or other device may be required for limited transient compensation between the center winder/unwinder and other driven parts of a line.

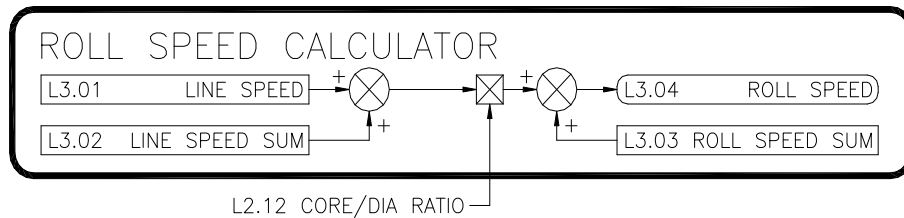


Figure 47

L3.01 Line Speed (R/W, Preset: 0.00%)

Represents the speed of the line. Typically, an analog or frequency input is linked to this parameter. The external signal should be scaled so that 0% represents stop and 100% represents maximum desired speed. Range: -100..100%

L3.02 Line Speed Sum (R/W, Preset: 0.00%)

This setting allows for a signal to be summed before the Core/Diameter Ratio (L2.12) is applied. In some engineered applications involving dancers or loadcells, the PID loop output is summed here. Range: -100..100%

L3.03 Roll Speed Sum (R/W, Preset: 0.00%)

This setting allows for a signal to be summed after the Core/Diameter Ratio (L2.12) is applied. In some engineered applications involving dancers or loadcells, the PID loop output is summed here. Range: -100..100%

L3.04 Roll Speed (RO)

This is the calculated center driven speed for the winder/unwinder roll.

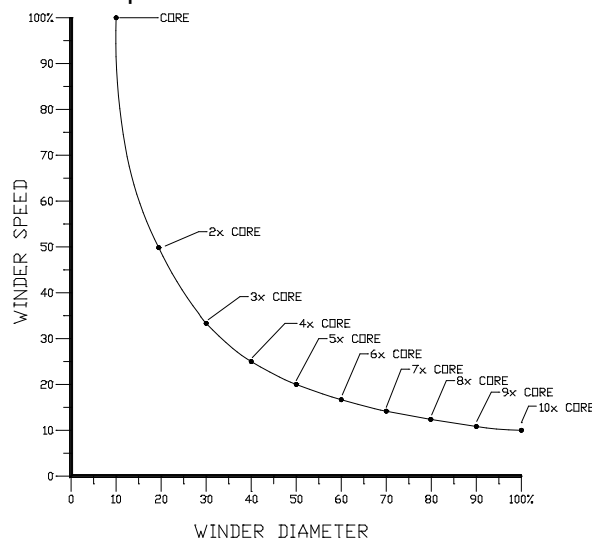


Figure 48

L4: Taper Tension Calculator

When center winding material, in some cases decreasing tension (taper tension) is desirable to prevent telescoping and/or wrinkling of inner layers of material. The taper tension calculator can be configured to provide tapering tension starting at any point in the roll diameter. Tension Demand (L4.04) will decrease by a percentage of the Tension Setpoint (L4.01) from the Taper Diameter (L4.02) setting to the Max Diameter (L2.03).

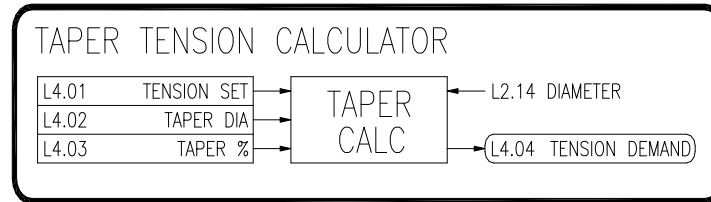


Figure 49

L4.01 Tension Setpoint (R/W, Preset: 0.00%)

The desired tension level. Range: 0..100%

L4.02 Taper Diameter (R/W, Preset: 600.00")

The diameter level at which tapering begins. Range: 0.01..600"

L4.03 Percent Taper (R/W, Preset: 0.00%)

Defines how much the tension demand is tapered (reduced). The amount of taper is a percentage of the setpoint. Refer to Figure 50. In this example, the Tension Setpoint (L4.01) is set to 100.00% and the Percent Taper (L4.03) is 20.00%. Thus, at maximum diameter, Tension Demand (L4.04) has decreased by 20% to 80%. If the Tension Setpoint is reduced to 50% and the other settings are unchanged, this results in a 10% taper. The 10.00% reduction is a decrease of 20% of the tension setpoint (i.e. 20% of 50 is 10%). Range: 0..100%

L4.04 Tension Demand (RO)

The tapered tension demand.

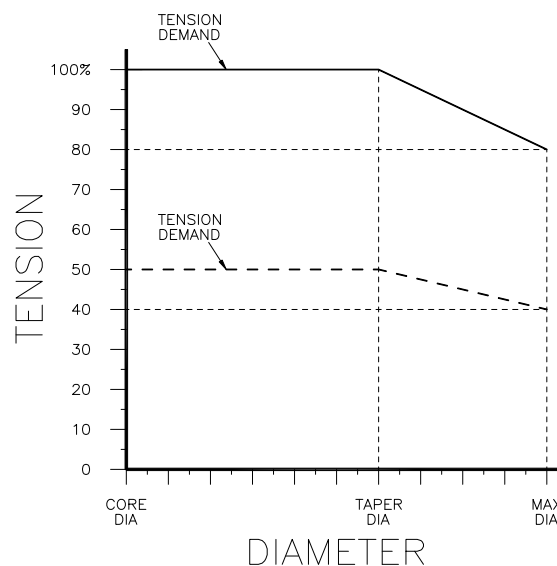


Figure 50

L5: CTCW Calculator

The CTCW (Constant Tension Center Wind) block allows the drive to provide constant or taper tension control without external tension sensors. The CTCW block provides a torque reference output that is composed of diameter torque, inertia torque, friction torque, static friction torque, and pulse torque. Diameter torque is supplied to compensate for the increase in roll diameter. Inertia torque is supplied when the line is accelerating. Friction torque must also be supplied to overcome the mechanics in the drive train. A momentary pulse of torque (pulse torque) can be supplied to help 'break away' the mechanics of the system.

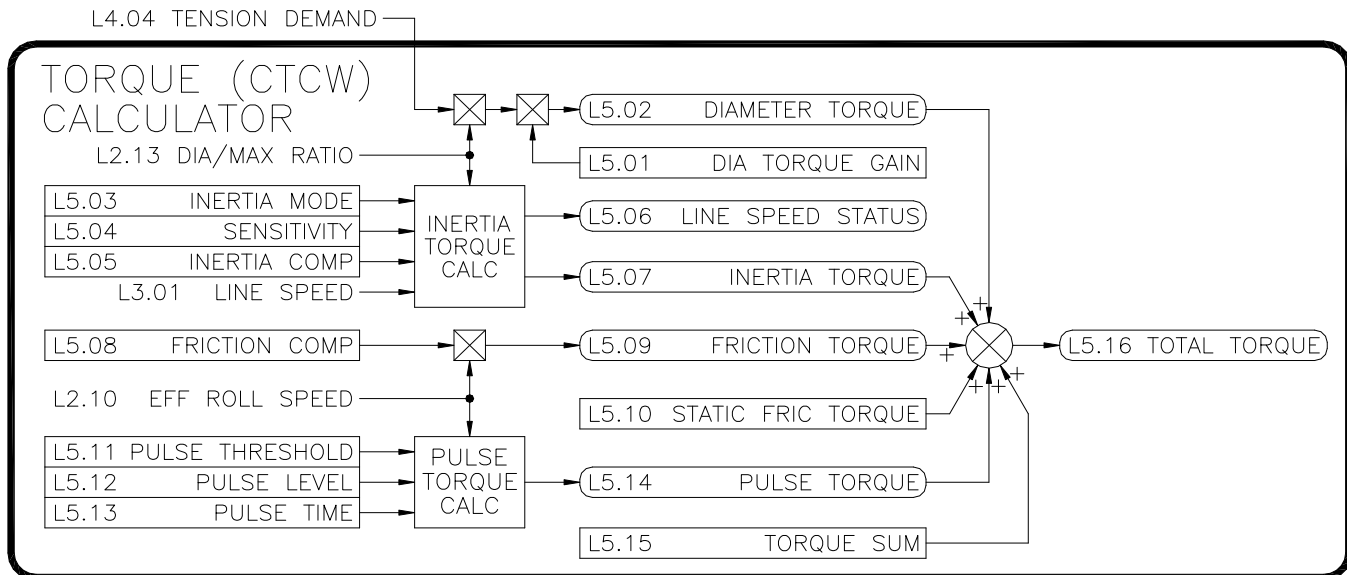


Figure 51

L5.01 Diameter Torque Gain (R/W, Preset: 100.00%)

This parameter provides a gain adjustment for the Diameter Torque (L5.02). Typically, the maximum amount of torque that the motor (and gearing) can provide is greater than the actual amount of torque required to provide the desired tension level at the maximum diameter. This trim adjustment provides a means to scale the Diameter Torque level so that a Tension Demand (L4.04) level of 100% provides only the required torque level to achieve 100% tension. Range: 0..300%

L5.02 Diameter Torque (RO)

In order to provide constant tension, the winder torque must increase proportionally to the increase in diameter. This signal is produced with input from the Diameter Calculator and the Taper Tension Calculator.

L5.03 Inertial Mode (R/W, Preset: Accel)

Controls the type of inertia compensating torque supplied. Typically, winders (takeups) need **ACCEL** compensation and unwinders (letoffs) need **DECEL** compensation.

L5.04 Inertial Sensitivity (R/W, Preset: 5)

The Inertia Torque calculator monitors the Line Speed (L3.01) parameter to provide an Inertia Torque (L5.07) compensation. The level of compensation depends upon how fast the line speed is changing. This derivative calculation is made by examining the Line Speed at a set interval and determining the amount of change. The sensitivity adjustment controls the amount of time between samples. With fast line acceleration/deceleration rates of a few seconds, the sampling time can be set at 1 or 2. With slower accel/decel rates, the time between samples typically

would need to be increased. Refer to the following table for recommended initial values depending upon the line accel/decel rates. Note that these values may need to be adjusted to obtain steady levels of Inertia Torque depending upon the amount of electrical noise present on the signal. Range: 1..10

Line Speed Accel/Decel Times	Recommended L5.04 Value
1-3	1
4-7	2
8-11	3
12-13	4
14-20	5
21-26	6
27 or higher	7

Table 16: Inertia Sensitivity

L5.05 Inertia Compensation (R/W, Preset: 5)

Additional torque is required by the winder drive when the line speed is accelerating. This parameter is used in conjunction with Line Speed (L3.01) to control the amount of additional Inertia Torque (L5.07). Range: 0..100%

L5.06 Line Speed Status (RO)

This parameter that displays the status of the Line Speed (L3.01): **DECELERATING, AT SPEED, or ACCELERATING.**

L5.07 Inertia Torque (RO)

The amount of additional torque reference supplied when the line is accelerating or decelerating. Parameters L5.03-L5.05 and L3.01 affect this level.

L5.08 Friction Comp (R/W, Preset: 0.00%)

This parameter is multiplied by the winder roll speed to produce the Friction Torque level (L5.09). Range: 0..100%

L5.09 Friction Torque (RO)

Torque is required to overcome the friction in the mechanics of the drive train. The torque required is proportional to the winder roll speed.

L5.10 Static Friction Comp (R/W, Preset: 0.00%)

This parameter provides a minimum (or bias) starting torque level. Range: 0..100%

L5.11 Pulse Threshold (R/W, Preset: 0.00%)

The level that the Line Speed (L3.01) signal must exceed before pulse torque is supplied. After the pulse torque has been applied, the Line Speed signal must return to 0.00% and again exceed the threshold for pulse torque to be reapplied.

Range: 0..100%

L5.12 Pulse Level (R/W, Preset: 0.00%)

When the mechanics of a system are oversized for the desired level of tension, the friction of the system while stopped many need to be overcome with additional starting torque. This additional torque is only needed momentarily to 'break away' the mechanics of the system. This parameters sets the level of torque to be momentarily applied. Range: 0..100%

L5.13 Pulse Time (R/W, Preset: 0.5 Secs)

The amount of time that the pulse torque signal is applied. Range: 0.1..10 Secs

L5.14 Pulse Torque (RO)

When the Line Speed (L3.01) exceeds L5.11, the level of L5.12 is applied to L5.14 for the time set by L5.13. After the time expires, L5.14 returns to zero. The line speed must return to 0% and exceed the L5.11 value again for the pulse torque to be re-applied.

L5.15 Torque Sum (R/W, Preset: 0.00%)

This parameter provides an auxiliary summing point before the Total Torque is calculated. A typical use would be to sum in a correction signal from the output of a PID block when loadcells are used with the CTCW Calculator. Range: 0..100%

L5.16 Total Torque (RO)

The sum of the L5.02, L5.07, L5.09, L5.10, L5.14 & L5.15. This parameter is typically used as the reference if the drive is in the torque mode. If the drive is in the velocity mode, it is often used as a current limit.

L6: MOP (Motor Operated Potentiometer)

In many industrial applications, a potentiometer is used to provide a reference signal (typically speed) to a machine. Often, it would be advantageous to allow the machine operator to adjust this potentiometer from multiple locations (especially on large machines). However, this is not possible with a standard analog potentiometer. In the past, to overcome this limitation, a potentiometer was mechanically connected to a motor shaft. INCREASE and DECREASE buttons could then be used to slowly rotate the motor one direction or the other, thus changing the output signal from the potentiometer. Multiple buttons could be wired in parallel, allowing INCREASE and DECREASE adjustment in multiple locations. This setup was called a Motor Operated Potentiometer (MOP). The drive has an electronic MOP block that performs this function.

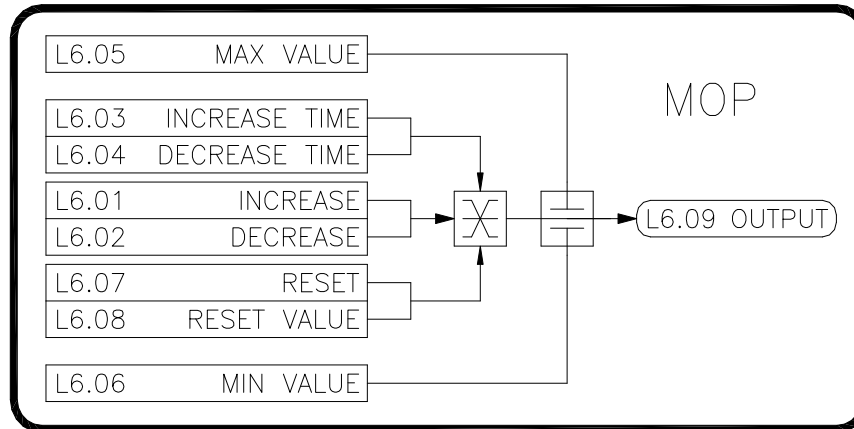


Figure 52

L6.01 MOP Increase (R/W, Preset: Off)

When **ON**, L6.09 increases at the rate defined by L6.03 up to a maximum value of L6.05. When **OFF**, L6.09 stops increasing and holds its value.

L6.02 MOP Decrease (R/W, Preset: Off)

When **ON**, L6.09 decreases at the rate defined by L6.04 down to a minimum value of L6.06. When **OFF**, L6.09 stops decreasing and holds its value.

L6.03 Increase Time (R/W, Preset: 10.0 Secs)

Defines the time it takes for L6.09 to make a 100% change. Range: 0.1..600 Secs

L6.04 Decrease Time (R/W, Preset: 10.0 Secs)

Defines the time it takes for L6.09 to make a 100% change. Range: 0.1..600 Secs

L6.05 MOP Max Value (R/W, Preset: 100.00%)

Defines the upper limit for L6.09. Range: -300..300%

L6.06 MOP Min Value (R/W, Preset: 100.00%)

Defines the lower limit for L6.09. Range: -300..300%

L6.07 MOP Reset (R/W, Preset: Off)

When **ON**, L6.09 will have the value of L6.08.

L6.08 Reset Value (R/W, Preset: Off)

Defines the value that L6.09 has when L6.07 is **ON**. Range: -300..300%

L6.09 MOP Output (R/W, Preset: Off)

The output of the MOP block.

7.13 M: Thresholds

The threshold blocks compare an input value to two threshold levels. When the input value equals or exceeds the On Level, an internal switch is turned on. When the input equals or falls below the Off Level, the switch turns off. Two threshold levels are provided so that a hysteresis may be created if desired. The switch has two inputs and one output.

M1: Threshold 1

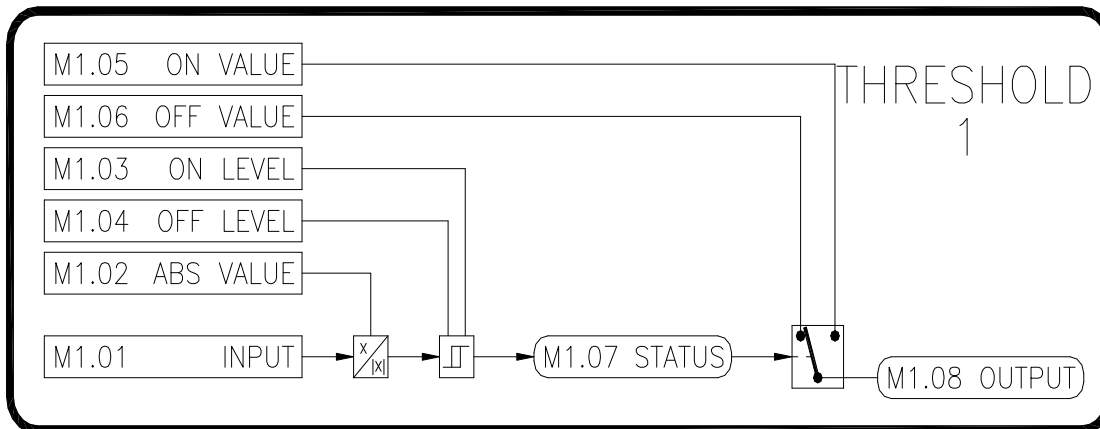


Figure 53

M1.01 Threshold 1 Input (R/W, Preset: 0.00%)

The value of the internal parameter that serves as the control for the switch. An input or internal link must be used to connect the desired parameter to this input. Range: -300..300%

M1.02 Threshold 1 Abs Value (R/W, Preset: Off)

When ON, the absolute value of M1.01 is taken before the comparison to the thresholds.

M1.03 Threshold 1 On Level (R/W, Preset: 50.00%)

When M1.01 equals or exceeds this level, the switch is on. Range: -300..300%

M1.04 Threshold 1 Off Level (R/W, Preset: 40.00%)

When M1.01 equals or falls below this level, the switch is off. Range: -300..300%

M1.05 Threshold 1 On Val (R/W, Preset: 100.00%)

The ON input to the switch. The value is selected when the switch is on. Range: -300..300%

M1.06 Threshold 1 Off Val (R/W, Preset: 0.00%)

The OFF input to the switch. The value is selected when the switch is off. Range: -300..300%

M1.07 Threshold 1 Status (RO)

Displays the status of the threshold switch, either ON or OFF.

M1.08 Threshold 1 Output (RO)

The output of the threshold block. This parameter will equal M1.05 when the switch is on. It will equal M1.06 when the switch is off.

M2: Threshold 2

M3: Threshold 3

M4: Threshold 4

M5: Threshold 5

M6: Threshold 6

Thresholds 2-6 are functionally identical to Threshold 1. Refer to M1.XX.

7.14 N: Timers

The drive provided six timer blocks. Each of the timers can operate in one of six modes.

N1: Timer 1

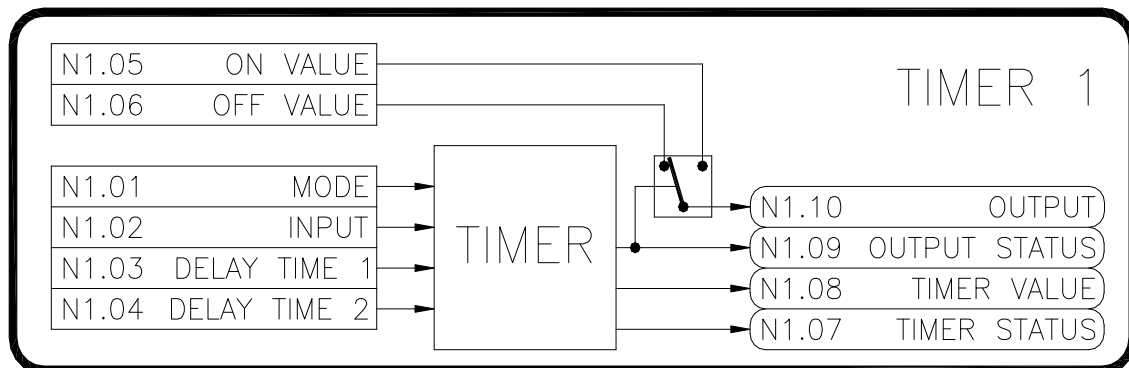


Figure 54

N1.01 Timer 1 Mode (R/W, Preset: On Delay)

Selects the operating mode of the timer. Refer to Figure 55.

ON DELAY

When N1.02 changes to **ON**, the internal switch turns on after a delay set by N1.03. When the input changes to **OFF**, the internal switch turns off immediately.

OFF DELAY

When N1.02 changes to **OFF**, the internal switch turns off after a delay set by N1.03. When the input changes to **ON**, the internal switch turns on immediately.

ONE SHOT

When N1.02 changes to **ON**, the internal switch turns on immediately. After a delay set by N1.03, the switch turns off. The timer ignores any successive input changes while the timer is timing (i.e. successive input changes do not reset the timing). After the timer has stopped, the timer can be restarted by toggling N1.02 from **OFF** to **ON**.

ONE SHOT (RE-TRIGGERABLE)

Performs the same as the **ONE SHOT** described above, except that successive state changes on the input restart the timing.

SINGLE CYCLE

When N1.02 changes to **ON**, the timer executes a delay defined by N1.03. After the delay, the switch turns on for the amount of time set by N1.04.

REPEAT CYCLE

When N1.02 changes to **ON**, the switch immediately turns on for the time defined by N1.03. Then the switch turns off for the time defined by N1.04. The cycle continues to repeat until N1.02 is **OFF**.

N1.02 Timer 1 Input (R/W, Preset: Off)

The input to the timer block.

N1.03 Timer 1 Delay Time 1 (R/W, Preset: 5.0 Secs)

Initial delay time. Range: 0.1..600 Secs

N1.03 Timer 1 Delay Time 1 (R/W, Preset: 5.0 Secs)

Second delay time. Used only when N1.01 is set to **SINGLE CYCLE** or **REPEAT CYCLE**.
Range: 0.1..600 Secs

N1.05 Timer 1 On Value (R/W, Preset: 100.00%)

The ON input to the switch. The value is selected when the switch is on. Range: -300..300%

N1.06 Timer 1 Off Value (R/W, Preset: 0.00%)

The OFF input to the switch. The value is selected when the switch is off. Range: -300..300%

N1.07 Timer 1 Status (RO)

Indicates the status of the timer: **STOPPED** or **TIMING**.

N1.08 Timer 1 Value (RO)

The value of the timer.

N1.09 Timer 1 Output Status (RO)

Displays the status of the timer switch, either **ON** or **OFF**.

N1.10 Timer 1 Output (RO)

The output of the timer block. This parameter will equal N1.05 when the switch is on. It will equal N1.06 when the switch is off.

- N2: Timer 2
- N3: Timer 3
- N4: Timer 4
- N5: Timer 5
- N6: Timer 6

Timers 2-6 are functionally identical to Timer 1. Refer to N1.XX.

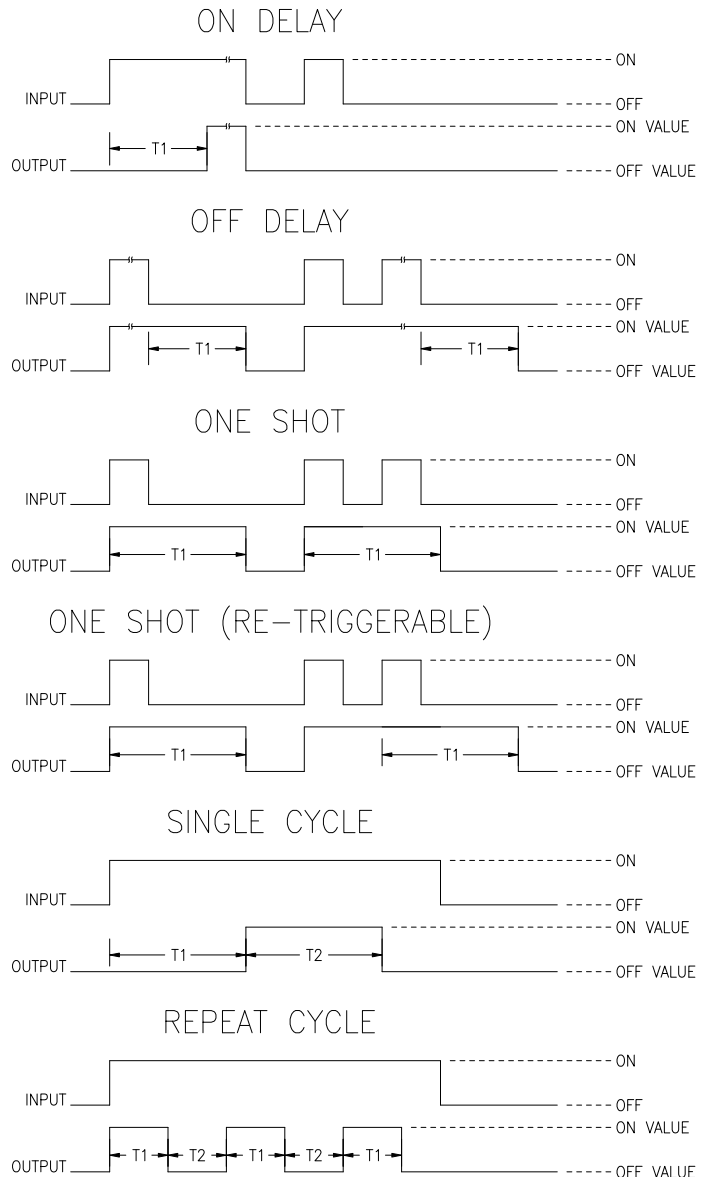


Figure 55

7.15 O: Logic Gates

The Logic Gate blocks provide basic boolean logic and comparison functions.

O1: Logic Gate 1

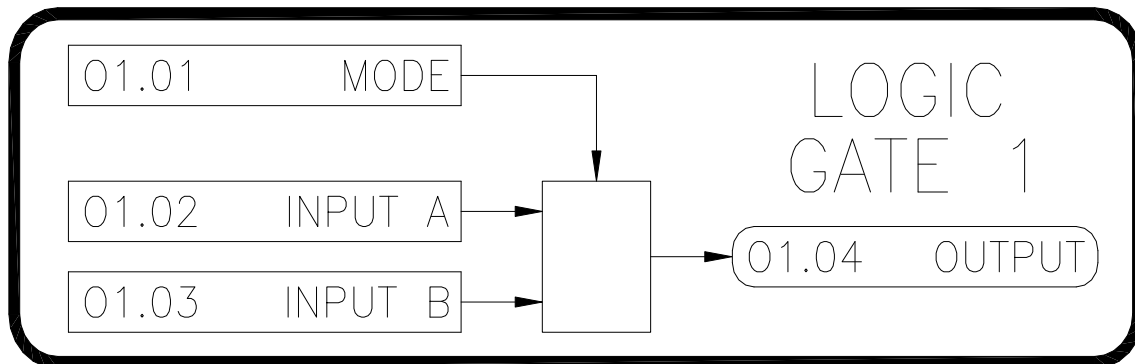


Figure 56

O1.01 Logic Gate 1 Mode (R/W, Preset: A And B)

Selects the function of the logic gate.

A AND B

Performs a logical AND between Inputs A (O1.02) and Input B (O1.03). The output (O1.04) will be **ON** only when both inputs are **OFF**. Refer to Table 17.

A NAND B

Performs a logical NAND between Inputs A (O1.02) and Input B (O1.03). The output (O1.04) will be **OFF** only when both inputs are **ON**. Refer to Table 17.

A OR B

Performs a logical OR between Inputs A (O1.02) and Input B (O1.03). The output (O1.04) will be **ON** when either of the inputs are **ON**. Refer to Table 17.

A NOR B

Performs a logical NOR between Inputs A (O1.02) and Input B (O1.03). The output (O1.04) will be **OFF** when either of the inputs are **ON**. Refer to Table 17.

A XOR B

Performs a logical XOR (exclusive or) between Inputs A (O1.02) and Input B (O1.03). The output (O1.04) will be **ON** when either of the inputs are **ON**, but not both. An alternative view is the output will be **ON** when the inputs are different from each other. Refer to Table 17.

A XNOR B

Performs a logical XNOR (exclusive nor) between Inputs A (O1.02) and Input B (O1.03). The output (O1.04) will be **ON** when the inputs equal each other. Refer to Table 17.

NOT A (LOGICAL INVERT)

Performs a logical inversion of Input A. The output (O1.04) will be the opposite of Input A. Refer to Table 17.

A > B?

The output (O1.04) will be **ON** when Input A (O1.02) is greater than Input B (O1.03).

A >= B?

The output (O1.04) will be **ON** when Input A (O1.02) is greater than or equal to Input B (O1.03).

$A < B?$

The output (O1.04) will be **ON** when Input A (O1.02) is less than Input B (O1.03).

$A \leq B?$

The output (O1.04) will be **ON** when Input A (O1.02) is less than or equal to Input B (O1.03).

$A \text{ EQUALS } B?$

The output (O1.04) will be **ON** when Input A (O1.02) is equal to Input B (O1.03).

$A \text{ NOT EQUAL } B?$

The output (O1.04) will be **ON** when Input A (O1.02) is not equal to Input B (O1.03).

$|A|$

The output (O1.04) will be the absolute value of Input A (O1.02).

$-|A|$

The output (O1.04) will be the negative absolute value of Input A (O1.02).

$-A$

The output (O1.04) will be the negative of Input A (O1.02).

$A + B$

The output (O1.04) will be the sum of Input A (O1.02) and Input B (O1.03).

$A - B$

The output (O1.04) will be the difference between Input A (O1.02) and Input B (O1.03).

$A * B$

The output (O1.04) will be the product of Input A (O1.02) and Input B (O1.03).

A / B

The output (O1.04) will be the quotient (result) of Input A (O1.02) divided by Input B (O1.03).

FILTER

Input A (O1.02) is the filter input. Input B (O1.03) is the filter gain. The filter output is O1.04.

SR FLIP FLOP

Functions as a Set/Reset Flip Flop. Input A (O1.02) functions as the Set input. Input B (O1.03) functions as the Reset input. The flip flop output is O1.04. Refer to Table 17.

POS EDGE LATCH

The value of Input A (O1.02) is latched into the output (O1.04) when Input B (O1.03) changes from **OFF** to **ON**.

NEG EDGE LATCH

The value of Input A (O1.02) is latched into the output (O1.04) when Input B (O1.03) changes from **ON** to **OFF**.

O1.02 Logic Gate 1 Input A (R/W, Preset: False*)

Input A to the logic gate. *Note that the formatting/units of this parameter will change depending upon the mode selected by O1.01.

O1.03 Logic Gate 1 Input B (R/W, Preset: False*)

Input B to the logic gate. *Note that the formatting/units of this parameter will change depending upon the mode selected by O1.01.

O1.04 Logic Gate 1 Output (R/W, Preset: False*)

Output of the logic gate. *Note that the formatting/units of this parameter will change depending upon the mode selected by O1.01.

Input A (O1.02)	Input B (O1.03)	Output (O1.04)						
		AND	NAND	OR	NOR	XOR	XNOR	SR FF
Off	Off	Off	On	Off	On	Off	On	No Change
Off	On	Off	On	On	Off	On	Off	Off
On	Off	Off	On	On	Off	On	Off	On
On	On	On	Off	On	Off	Off	On	Off

Table 17: Logic Gates Truth Table

O2: Logic Gate 2

O3: Logic Gate 3

O4: Logic Gate 4

O5: Logic Gate 5

O6: Logic Gate 6

Logic Gates 2-6 are functionally identical to Logic Gate 1. Refer to O1.XX.

7.16 P: Switches

The drive provides 6 internal single pole double throw switches.

P1: Switch 1

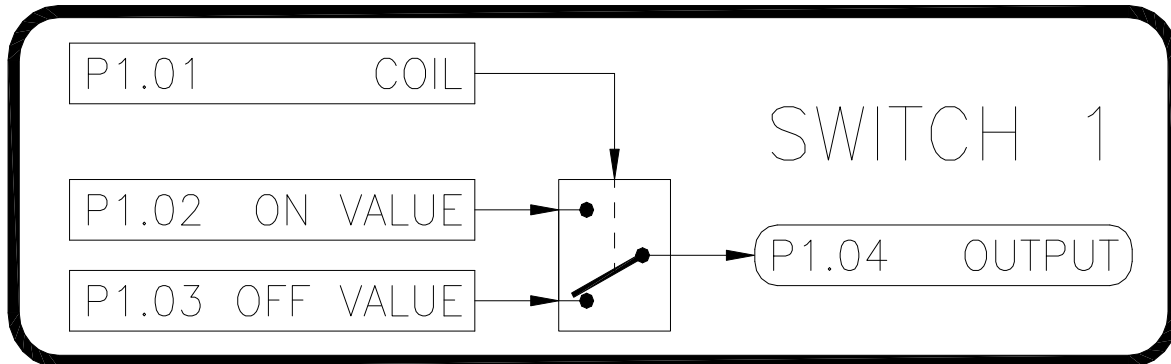


Figure 57

P1.01 Switch 1 Coil (R/W, Preset: Off)

Defines the status of the switch: **ON** or **OFF**.

P1.02 Switch 1 On Value (R/W, Preset: 0.00%)

The ON input to the switch. The value is selected when the switch is on.
Range: -327.68..327.67%

P1.03 Switch 1 Off Value (R/W, Preset: 0.00%)

The OFF input to the switch. The value is selected when the switch is off.
Range: -327.68..327.67%

P1.04 Switch 1 Output (RO)

The output of the switch. This parameter will equal P1.02 when the switch is on and P1.03 when the switch is off.

P2: Switch 2

P3: Switch 3

P4: Switch 4

P5: Switch 5

P6: Switch 6

Switches 2-6 are functionally identical to Switch 1. Refer to P1.XX.

7.17 Q: Internal Links

The internal links can be used to connect or link parameters together. The source parameter selects the parameter from which data will be retrieved. The destination parameter selects the parameter to which the data will be written. In other words, the value of the parameter identified by Source will be written to the parameter identified by Destination. The drive provides 30 links that are separated into 3 groups for custom configuration. Each link has a source and a destination.

Q1: Internal Link Group 1

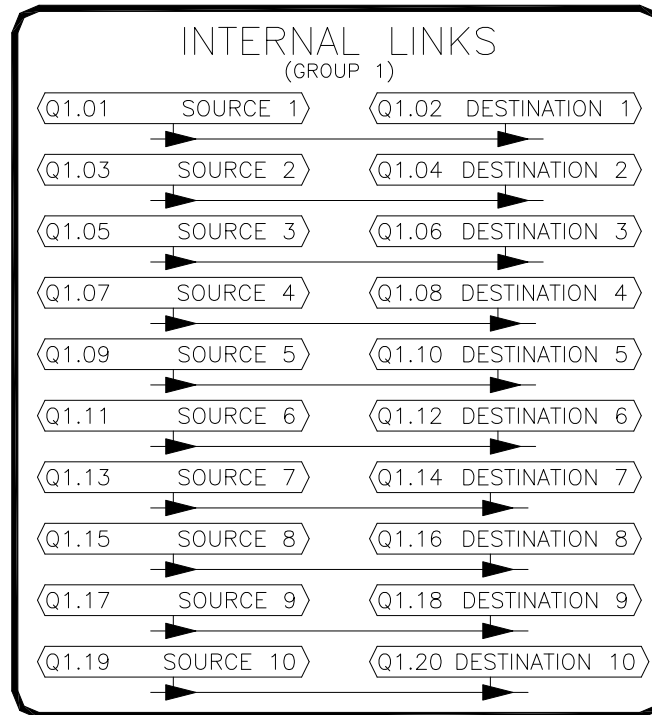


Figure 58

Q1.01 Internal Link 1 Src (ICR, Preset: J1.21 [Ramp Output])

Defines the source parameter via its tag.

Q1.02 Internal Link 1 Dest (ICR, Preset: G1.19 [Open Loop Ref])

Defines the destination or target parameter via its tag.

Q1.03 Internal Link 2 Src (ICR, Preset: J1.21 [Ramp Output])

Defines the source parameter via its tag.

Q1.04 Internal Link 2 Dest (ICR, Preset: G1.19 [Torque Reference])

Defines the destination or target parameter via its tag.

Q1.05-Q1.20

These parameters are functionally equivalent to the ones listed above. They do not have any preset values.

Q2: Internal Link Group 2

Q3: Internal Link Group 3

The Q2 and Q3 blocks are functionally identical to Q1. Refer to Q1.XX.

R1: Com Port A (CN12: USB)

R1.01 Port A Clear Counters (R/W, Preset: Off)

Resets R1.02-R1.10 to zero when set to **ON**. Value automatically returns to **OFF**.

R1.02 Port A Bus Messages (RO)

The total number of bus messages.

R1.03 Port A Bus Com Errors (RO)

The total number of bus messages that have errors.

R1.04 Port A Bus Exceptions (RO)

The total number of exception errors.

R1.05 Port A Device Message (RO)

The total number of messages that were addressed to this drive.

R1.06 Port A Device No Resp (RO)

The total number of times the drive did not respond to a message due to an error.

R1.07 Port A Break Detected (RO)

The total number of times the drive detected a break condition.

R1.08 Port A Framing Errors (RO)

The total number of times the drive detected a framing error.

R1.09 Port A Overrun Errors (RO)

The total number of times a buffer overrun error occurred.

R1.10 Port A Parity Errors (RO)

The total number of times a parity error was detected.

PORT A (USB)	
R1.01	CLEAR COUNTERS
R1.02	BUS MSG COUNT
R1.03	BUS COMM ERROR COUNT
R1.04	BUS EXC ERROR COUNT
R1.05	DEVICE MSG COUNT
R1.06	DEVICE NO RESP COUNT
R1.07	BREAK DETECTED COUNT
R1.08	FRAMING ERROR COUNT
R1.09	OVERRUN ERROR COUNT
R1.10	PARITY ERROR COUNT

Figure 59

R2: Com Port B (Option Slot)

R2.01 Port B Modbus Network Address (R/W, Preset: 1)

Sets the Modbus® network address of the drive. Range: 1..247

R2.02 Port B Baud Rate (R/W, Preset: 38400)

Sets the communication speed. Available rates are **2400, 4800, 9600, 19200, 38400, 57600, 76800, & 115200.**

R2.03 Port B Parity (R/W, Preset: None)

Sets the parity. Available selections are **NONE, ODD, & EVEN.**

R2.04 Port B Stop Bits (R/W, Preset: 2 Stop Bits)

Sets the number of stop bits. Available selections are **1 STOP BIT & 2 STOP BITS.**

R2.05 Port B Apply (R/W, Preset: Off)

Changes to parameters R2.01-R2.04 do not take affect until they are applied by setting this parameter to **ON**. The changes can also be applied by cycling power on the drive. Value automatically returns to **OFF**.

R2.06 Port B Clear Counters (R/W, Preset: Off)

Resets R2.02-R2.10 to zero when set to **ON**. Value automatically returns to **OFF**.

R2.07 Port B Bus Messages (RO)

The total number of bus messages detected. This includes messages that are not addressed to the drive.

R2.08 Port B Bus Com Errors (RO)

The total number of bus messages that have errors.

R2.09 Port B Bus Exceptions (RO)

The total number of exception errors.

R2.10 Port B Device Message (RO)

The total number of messages that were addressed to this drive.

R2.11 Port B Device No Resp (RO)

The total number of times the drive did not respond to a message due to an error.

R2.12 Port B Break Detected (RO)

The total number of times the drive detected a break condition.

R2.13 Port B Framing Errors (RO)

The total number of times the drive detected a framing error.

R2.14 Port B Overrun Errors (RO)

The total number of times a buffer overrun error occurred.

R2.15 Port B Parity Errors (RO)

The total number of times a parity error was detected.

R2.16 Port B Timeout Enable (R/W, Preset: Disabled)

When ENABLED, the drive will generate a fault or an alarm (selectable by R2.18) if the drive does not detect any communication activity within the time period set by R2.17.

R2.17 Port B Timeout Period (R/W, Preset: 0.5 Secs)

Determines the inactivity time that must occur on Port C before an R2.18 event is generated. Range: 0..20 Secs

R2.18 Port B Timeout Action (R/W, Preset: None)

Determines the action taken after inactivity on Port C. Available selections are **NONE, ALARM, & FAULT.**

R2.19 Port B Timeout Status (RO)

Used only when R2.16 is set to **ENABLED**. Displays the timeout status, either **ERROR** or **OK**.

PORT B (OPTION)

R2.01	NETWORK ADDRESS
R2.02	BAUD RATE
R2.03	PARITY
R2.04	STOP BITS
R2.05	APPLY
R2.06	CLEAR COUNTERS
R2.07	BUS MSG COUNT
R2.08	BUS COMM ERROR COUNT
R2.09	BUS EXC ERROR COUNT
R2.10	DEVICE MSG COUNT
R2.11	DEVICE NO RESP COUNT
R2.12	BREAK DETECTED COUNT
R2.13	FRAMING ERROR COUNT
R2.14	OVERRUN ERROR COUNT
R2.15	PARITY ERROR COUNT
R2.16	TIMEOUT ENABLE
R2.17	TIMEOUT PERIOD
R2.18	TIMEOUT ACTION
R2.19	TIMEOUT STATUS
R2.20	ETHERNET ADDR MODE
R2.21	IP ADDR 1
R2.22	IP ADDR 2
R2.23	IP ADDR 3
R2.24	IP ADDR 4
R2.25	SUBNET 1
R2.26	SUBNET 2
R2.27	SUBNET 3
R2.28	SUBNET 4
R2.29	GATEWAY 1
R2.30	GATEWAY 2
R2.31	GATEWAY 3
R2.32	GATEWAY 4
R2.33	TCP STATUS

Figure 60

R2.20 Port B Ethernet Address Mode (R/W, Preset: Auto)

When set to **AUTO**, the IP Address will be auto-assigned by a DHCP server on the network. Parameters R2.21-32 will display the assigned settings. When set to **MANUAL**, the IP Address settings are set by parameters R2.21-32.

R2.21 Port B IP Address 1 (R/W, Preset: 0)

R2.22 Port B IP Address 2 (R/W, Preset: 0)

R2.23 Port B IP Address 3 (R/W, Preset: 0)

R2.24 Port B IP Address 4 (R/W, Preset: 0)

These parameters set the IP Address of the unit when R2.20 is set to **MANUAL**. When R2.20 is set to **AUTO**, these parameters display the DHCP assigned IP address.

R2.25 Port B Subnet Mask 1 (R/W, Preset: 0)

R2.26 Port B Subnet Mask 2 (R/W, Preset: 0)

R2.27 Port B Subnet Mask 3 (R/W, Preset: 0)

R2.28 Port B Subnet Mask 4 (R/W, Preset: 0)

These parameters set the Subnet Mask of the unit when R2.20 is set to **MANUAL**. When R2.20 is set to **AUTO**, these parameters display the DHCP assigned Subnet Mask.

R2.29 Port B Gateway Address 1 (R/W, Preset: 0)

R2.30 Port B Gateway Address 2 (R/W, Preset: 0)

R2.31 Port B Gateway Address 3 (R/W, Preset: 0)

R2.32 Port B Gateway Address 4 (R/W, Preset: 0)

These parameters set the Gateway Address of the unit when R2.20 is set to **MANUAL**. When R2.20 is set to **AUTO**, these parameters display the DHCP assigned Gateway Address.

R2.33 Port B TCP Client Connected (RO)

Used only when R2.16 is set to **ENABLED**. Displays the timeout status, either **ERROR** or **OK**.

S1: Zero Speed

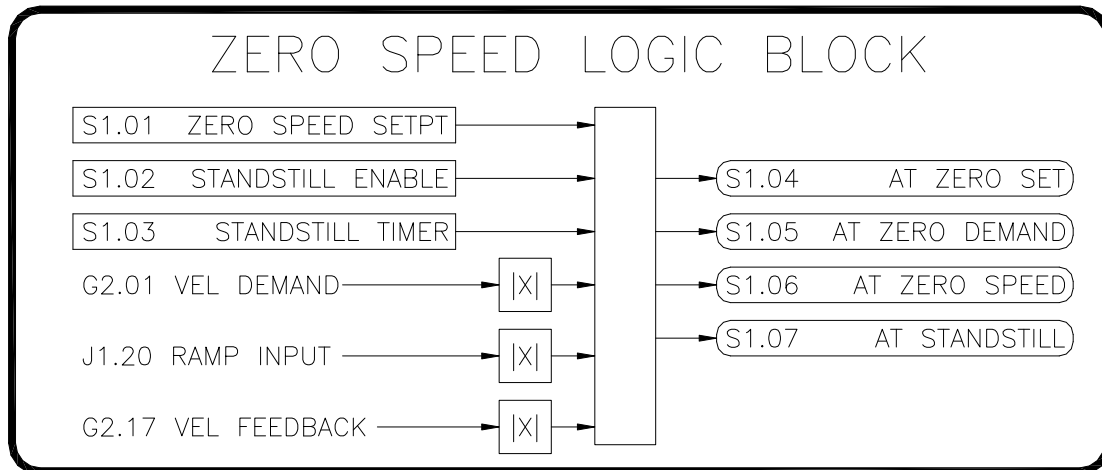


Figure 61

S1.01 Zero Speed Setpoint (R/W, Preset: 4.00%)

Sets the speed level that the drive considers to be stopped. When ramping to stop, the drive drops out the armature contactor when this level is reached. Range: 0.5..25%

S1.02 Standstill Enable (R/W, Preset: Enabled)

In applications where the drive is in the Run mode with zero velocity reference, motor creepage may be apparent under some load conditions. When **ENABLED**, the Standstill function clamps the loops while the drive's velocity reference and feedback are below the zero speed level.

S1.03 Standstill Timer (R/W, Preset: 0.1 Secs)

Defines the timer period where both the Velocity Demand (G2.01) and the Velocity Feedback (G2.17) must be below the Zero Speed Setpoint (S1.01) before At Standstill (S1.06) becomes **ON**. Range: 0..10 Secs

S1.04 At Zero Setpoint (RO)

ON indicates the Reference (I1.10) parameter is below the Zero Speed Setpoint (S1.01) .

S1.05 At Zero Demand (RO)

ON indicates the Velocity Demand (G2.01) parameter is below the Zero Speed Setpoint (S1.01) .

S1.06 At Zero Speed (RO)

ON indicates the Velocity Feedback (G2.17) parameter is below the Zero Speed Setpoint (S1.01).

S1.07 At Standstill (RO)

When S1.02 is **ENABLED**, a value of **ON** indicates that the drive's velocity demand (G2.01) and feedback (G2.17) are both below the zero speed setpoint (S1.01).

T1: System Status**T1.01 Drive Model (RO)**

Displays the drive's model number.

T1.02 Rated Armature Curr (RO)

Displays the drive's rated armature current.

T1.04 Firmware Version (RO)

Displays the drive's firmware version.

T1.08 Edit In Progress (RO)

ON indicates a drive parameter is being edited via the keypad. The drive is prohibited from running in this state.

T1.09 Reset Source (RO)

Displays the source of the last processor reset: **EXTERNAL**, **WATCHDOG**, or **SOFTWARE**.

T1.15 EEPROM Fault Status (RO)

Displays the status of the last EEPROM operation: **NO FAULT**, **READ FAULT**, **WRITE FAULT**.

T1.16 EEPROM Alarm Status Code (RO)

Displays the EEPROM alarm code that generated the alarm. An EEPROM alarm is generated if an error occurs whenever the drive attempts to save a parameter to the EEPROM.

T1.17 Option Board ID Raw (RO)

Displays the raw option board ID value.

T1.18 Option Board ID (RO)

Displays the installed option board ID.

SYSTEM STATUS	
T1.01	DRIVE MODEL
T1.02	RATED ARMATURE CURRENT
T1.04	FIRMWARE VERSION
T1.08	MENU EDIT IN PROGRESS
T1.09	RESET SOURCE
T1.10	RESERVED
T1.15	EEPROM FAULT STATUS
T1.16	EEPROM ALARM STATUS
T1.17	OPTION BOARD ID RAW
T1.18	OPTION BOARD ID

Figure 62

T2: System Options

T2.01 Parameter Save (R/W, Preset: Off)

When parameter changes are made via the keypad, the changes are automatically saved. Parameters changes made over one of the communication ports are not saved. Setting this parameter to **ON** will save all of the current drive parameters. Value automatically returns to **OFF**.

T2.02 Line Freq Select (ICR, Preset: Auto)

Determines how the drive detects the frequency of the incoming three phase AC line. When set to **AUTO**, the drive will automatically detect the incoming frequency. If the drive has trouble detecting the frequency, it can be specifically set to **50 HZ** or **60 HZ**.

T2.03 Line Freq Status (RO)

When T2.02 is set to **AUTO**, this indicates the line frequency detected by the drive. If a specific frequency is selected via T2.02, it will also be displayed here.

T2.04 Regenerative Enable (ICR, Preset: Enabled)

Used only when T1.07 is **REGENERATIVE**. When **DISABLED**, the reverse bridge is disabled and forces a regenerative drive to emulate a non-regenerative drive.

SYSTEM OPTIONS	
T2.01	PARAMETER SAVE
T2.02	LINE FREQ SELECTION
T2.03	LINE FREQUENCY STATUS
T2.04	REGEN ENABLE

Figure 63

7.21 U: Auxiliary

The drive provides 20 auxiliary parameters for general purpose use. Many times they are used when it is desired to link an input to an output. Since this cannot be done directly, an auxiliary parameter can be used as a tie point. Also, the drive's inputs and outputs can be used as remote I/O via the communications ports. In these cases, the auxiliary parameters can be used as a destination for the inputs or a source for the outputs.

U1: Auxiliary

- U1.01 Aux 1 (R/W, Preset: 0.00%)**
- U1.02 Aux 2 (R/W, Preset: 0.00%)**
- U1.03 Aux 3 (R/W, Preset: 0.00%)**
- U1.04 Aux 4 (R/W, Preset: 0.00%)**
- U1.05 Aux 5 (R/W, Preset: 0.00%)**
- U1.06 Aux 6 (R/W, Preset: 0.00%)**
- U1.07 Aux 7 (R/W, Preset: 0.00%)**
- U1.08 Aux 8 (R/W, Preset: 0.00%)**
- U1.09 Aux 9 (R/W, Preset: 0.00%)**
- U1.10 Aux 10 (R/W, Preset: 0.00%)**
- U1.11 Aux 11 (R/W, Preset: 0.00%)**
- U1.12 Aux 12 (R/W, Preset: 0.00%)**
- U1.13 Aux 13 (R/W, Preset: 0.00%)**
- U1.14 Aux 14 (R/W, Preset: 0.00%)**
- U1.15 Aux 15 (R/W, Preset: 0.00%)**
- U1.16 Aux 16 (R/W, Preset: 0.00%)**
- U1.17 Aux 17 (R/W, Preset: 0.00%)**
- U1.18 Aux 18 (R/W, Preset: 0.00%)**
- U1.19 Aux 19 (R/W, Preset: 0.00%)**
- U1.20 Aux 20 (R/W, Preset: 0.00%)**

Range: -327.68..+327.67%

U1.01	AUX 1
U1.02	AUX 2
U1.03	AUX 3
U1.04	AUX 4
U1.05	AUX 5
U1.06	AUX 6
U1.07	AUX 7
U1.08	AUX 8
U1.09	AUX 9
U1.10	AUX 10
U1.11	AUX 11
U1.12	AUX 12
U1.13	AUX 13
U1.14	AUX 14
U1.15	AUX 15
U1.16	AUX 16
U1.17	AUX 17
U1.18	AUX 18
U1.19	AUX 19
U1.20	AUX 20

Figure 64

7.22 Parameter Table

The following table lists all the Trooper® Pro parameters and their properties.

ICR=Inhibit Change while Running

RW=Read/Write

RO=Read Only

Table 18: Parameters

Tag	Modbus Address	Parameter Name	Access	Range	Preset	Note
A1.02	2178	Operating Mode	ICR	Vel..Torq	Velocity	
A1.03	2179	Initialize	ICR	0..65535	0	
A1.04	2180	Define Password	RW	0..65535	0	
A1.05	2181	Enter Password	RW	0..65535	0	
B1.01	4225	Digital Input 1 Destination	ICR	A1.01..U1.20	H1.12	
B1.02	4226	Digital Input 1 Status	RO	Off..On	Off	
B1.03	4227	Digital Input 1 Off Value	RW	Varies	0	
B1.04	4228	Digital Input 1 On Value	RW	Varies	1	
B2.01	4353	Digital Input 2 Destination	ICR	A1.01..U1.20	H1.02	
B2.02	4354	Digital Input 2 Status	RO	Off..On	Off	
B2.03	4355	Digital Input 2 Off Value	RW	Varies	0	
B2.04	4356	Digital Input 2 On Value	RW	Varies	1	
B3.01	4481	Digital Input 3 Destination	ICR	A1.01..U1.20	H1.03	
B3.02	4482	Digital Input 3 Status	RO	Off..On	Off	
B3.03	4483	Digital Input 3 Off Value	RW	Varies	0	
B3.04	4484	Digital Input 3 On Value	RW	Varies	1	
B4.01	4609	Digital Input 4 Destination	ICR	A1.01..U1.20	H1.04	
B4.02	4610	Digital Input 4 Status	RO	Off..On	Off	
B4.03	4611	Digital Input 4 Off Value	RW	Varies	0	
B4.04	4612	Digital Input 4 On Value	RW	Varies	1	
B5.01	4737	Digital Input 5 Destination	ICR	A1.01..U1.20	H1.05	
B5.02	4738	Digital Input 5 Status	RO	Off..On	Off	
B5.03	4739	Digital Input 5 Off Value	RW	Varies	0	
B5.04	4740	Digital Input 5 On Value	RW	Varies	1	
B6.01	5121	Frequency Input Destination	ICR	A1.01..U1.20	00.00	
B6.02	5122	Frequency Input Mode	ICR	Freq..Counter..Encoder	Encoder	
B6.03	5123	Frequency Input Status	RO	0..50,000Hz	0Hz	
B6.05	5125	Frequency Input Filtering	RW	0..15	0	
B6.06	5126	Frequency Input 0% Calibration	RW	0..50,000Hz	0Hz	
B6.07	5127	Frequency Input 100% Calibration	RW	0..50,000Hz	50,000Hz	
B6.10	5130	Frequency Input Bias	RW	Varies by Destination	0.00	
B6.11	5131	Frequency Input Gain	RW	Varies by Destination	100.00	
B6.12	5132	Frequency Input Polarity	RW	Pos..Neg	Pos	
B6.20	5140	Counter Destination	ICR	A1.01..U1.20	00.00	
B6.21	5141	Counter Enable	RW	Disabled..Enabled	Disabled	
B6.22	5142	Counter Direction	RW	Down..Up	Up	
B6.23	5143	Rollover Enable	RW	Disabled..Enabled	Disabled	
B6.24	5144	Counter Reset	RW	Off..On	Off	
B6.25	5145	Reset Value Low	RW	0..65535	0	
B6.26	5146	Reset Value High	RW	0..65535	0	
B6.27	5147	Count Low	RO	0..65535	0	
B6.28	5148	Count High	RO	0..65535	0	
B6.29	5149	Divisor	RW	1..65535	1	
C1.01	6273	Analog Input 1 Destination	ICR	A1.01..U1.20	I1.04	
C1.02	6274	Analog Input 1 Status	RO	-2048..2047	0	
C1.03	6275	Analog Input 1 Polarity	ICR	Unipolar..Bipolar	Unipolar	
C1.04	6276	Analog Input 1 Filtering	RW	0..15	0	
C1.05	6277	Analog Input 1 Type	RO	Voltage	Voltage	
C1.06	6278	Analog Input 1 0% Cal	RW	0..2047	0	
C1.07	6279	Analog Input 1 100% Cal	RW	0..2047	1862	

Tag	Modbus Address	Parameter Name	Access	Range	Preset	Note
C1.10	6282	Analog Input 1 Bias	RW	Varies by Destination	0.00%	
C1.11	6283	Analog Input 1 Gain	RW	Varies by Destination	100.00%	
C2.01	6401	Analog Input 2 Destination	ICR	A1.01..U1.20	00.00	
C2.02	6402	Analog Input 2 Status	RO	-2048..2047/0..4095	0	
C2.03	6403	Analog Input 2 Polarity	ICR	Unipolar..Bipolar	Unipolar	
C2.04	6404	Analog Input 2 Filtering	RW	0..15	0	
C2.05	6405	Analog Input 2 Type	ICR	Voltage..Current	Voltage	
C2.06	6406	Analog Input 2 0% Cal	RW	-2048..2047/0..4095	0	
C2.07	6407	Analog Input 2 100% Cal	RW	-2048..2047/0..4095	1862	
C2.10	6410	Analog Input 2 Bias	RW	Varies by Destination	0.00	
C2.11	6411	Analog Input 2 Gain	RW	Varies by Destination	100.00	
D1.01	8321	Relay Output 1 Source	ICR	A1.01..U1.20	H1.16	
D1.02	8322	Relay Output 1 Absolute Value	RW	Off..On	Off	
D1.03	8323	Relay Output 1 On Value	RW	Varies by Destination	0.01%	
D1.04	8324	Relay Output 1 Off Value	RW	Varies by Destination	0.00%	
D1.05	8325	Relay Output 1 Status	RO	Off..On	Off	
D2.01	8449	Relay Output 2 Source	ICR	A1.01..U1.20	S1.06	
D2.02	8450	Relay Output 2 Absolute Value	RW	Off..On	Off	
D2.03	8451	Relay Output 2 On Value	RW	Varies by Destination	0.01%	
D2.04	8452	Relay Output 2 Off Value	RW	Varies by Destination	0.00%	
D2.05	8453	Relay Output 2 Status	RO	Off..On	Off	
E1.01	10369	Analog Output 1 Source	ICR	A1.01..U1.20	G2.18	
E1.02	10370	Analog Output 1 Gain	RW	-300.00..300.00%	100.00%	
E1.03	10371	Analog Output 1 Bias	RW	-300.00..300.00%	0.00%	
E1.04	10372	Analog Output 1 Absolute Value	RW	Off..On	Off	
E1.05	10373	Analog Output 1 Status	RO	-2048..2047	0	
E2.01	10497	Analog Output 2 Source	ICR	A1.01..U1.20	G1.13	
E2.02	10498	Analog Output 2 Gain	RW	-300.00..300.00%	100.00%	
E2.03	10499	Analog Output 2 Bias	RW	-300.00..300.00%	0.00%	
E2.04	10500	Analog Output 2 Absolute Value	RW	Off..On	Off	
E2.05	10501	Analog Output 2 Status	RO	-2048..2047	0	
F1.02	12418	Armature Current	ICR	Varies	0.0A	
F1.03	12419	Armature Voltage	ICR	0..180V	0V	
F1.07	12423	Base Speed	ICR	0..9999 RPM	0 RPM	
F2.02	12546	Invert Tach	ICR	Off..On	Off	
F3.02	12674	Encoder Pulses/Rev	ICR	1..65535	1024	
G1.01	14465	Reference Select	ICR	Normal..Step	Normal	
G1.02	14466	Torque Reference	RW	-150.00..150.00%	0.00%	
G1.03	14467	Current Demand	RO	-150.00..150.00%	0.00%	
G1.04	14468	Aux Demand	RW	-150.00..150.00%	0.00%	
G1.05	14469	Positive Current Limit	RW	0..150.00%	150.00%	
G1.06	14470	Negative Current Limit	RW	0..150.00%	150.00%	
G1.08	14472	Final Current Demand	RO	-150.00..150.00%	0.00%	
G1.09	14473	Final Current Demand Filtered	RO	-150.00..150.00%	0.00%	
G1.10	14474	Raw Current Feedback	RO	-2048..2047	0	
G1.11	14475	Current Feedback Cal Gain	ICR	90.00%..110.00%	100.00%	
G1.12	14476	Current Feedback	RO	-150.00..150.00%	0.00%	
G1.13	14477	Current Feedback Filtered	RO	-150.00..150.00%	0.00%	
G1.14	14478	Armature Amps	RO	Varies by Model	0.0A	
G1.15	14479	Current Error	RO	-300.00%..300.00%	0.00%	
G1.16	14480	Current Proportional Gain	RW	0.00..15.00	2.30	
G1.17	14481	Current Integral Time	RW	0.001..30.000Secs	0.400Secs	
G1.19	14483	Loop Mode	ICR	Open..Closed	Closed	
G1.20	14484	Open Loop Reference	RW	-100.00%..100.00%	0.00%	
G1.21	14485	Conduction	RO	-100.00%..100.00%	0.00%	
G1.23	14487	Step Reference	RW	-150.00..150.00%	0.00%	
G1.24	14488	Step Duration	RW	0.000..10.000Secs	0.200Secs	
G1.25	14489	Step Enable	RW	Disabled..Enabled	Disabled	
G1.26	14490	Foldback Alarm Status	RO	Off..On	Off	
G1.27	14491	Armature Overcurrent Status	RO	Off..On	Off	

Tag	Modbus Address	Parameter Name	Access	Range	Preset	Note
G1.28	14492	Armature Current Feedback Offset	RW	-200..200	0	
G2.01	14593	Velocity Demand	RO	-100.00%..100.00%	0.00%	
G2.02	14594	Forward Max Speed Scale	RW	0.00%..105.00%	100.00%	
G2.03	14595	Reverse Max Speed Scale	RW	0.00%..105.00%	100.00%	
G2.04	14596	Final Velocity Demand	RO	-105.00%..105.00%	0.00%	
G2.05	14597	Armature Feedback Raw	RO	-2048..2047	0	
G2.06	14598	Armature Feedback	RO	-120.00%..120.00%	0.00%	
G2.07	14599	Armature Feedback Filtered	RO	-120.00%..120.00%	0.00%	
G2.08	14600	Armature Voltage	RO	-600..600V	0V	
G2.09	14601	IR Compensation	RW	0.00..30.00%	0.00%	
G2.10	14602	Tach Feedback Raw	RO	-2048..2047	0	
G2.11	14603	Tach Feedback	RO	-125.00%..125.00%	0.00%	
G2.12	14604	Tach Feedback Filtered	RO	-125.00%..125.00%	0.00%	
G2.13	14605	Encoder Feedback	RO	-125.00%..125.00%	0.00%	
G2.14	14606	Encoder Feedback Filtered	RO	-125.00%..125.00%	0.00%	
G2.15	14607	Feedback Select	ICR	Arm..Tach..Encoder	Armature	
G2.16	14608	VFB Offset	RW	-10.00%..10.00%	0.00%	
G2.17	14609	Velocity Feedback	RO	-125.00%..125.00%	0.00%	
G2.18	14610	Velocity Feedback Filtered	RO	-125.00%..125.00%	0.00%	
G2.19	14611	Velocity Error	RO	-200.00%..200.00%	0.00%	
G2.21	14613	Velocity Prop Gain	RW	0.000..20.000	9.000	
G2.22	14614	Velocity Integral Time	RW	0.000..30.000Secs	0.164Secs	
G2.23	14615	Velocity Derivative Gain	RW	0.000..30.000	0.000	
G2.27	14619	Velocity Loop Output	RO	-150.00%..150.00%	0.00%	
G2.28	14620	Custom Scale Enable	RW	Off..On	Off	
G2.29	14621	Custom RPM Scale	RW	0..10000RPM	0RPM	
G2.30	14622	Motor RPM	RO	-10000..10000RPM	0RPM	
G2.31	14623	Reference Select	ICR	Normal..Step	Normal	
G2.32	14624	Step Reference	RW	-100.00..100.00%	0.00%	
G2.33	14625	Step Duration	RW	0..30Secs	2Secs	
G2.34	14626	Step Enable	RW	Disabled..Enabled	Disabled	
G2.35	14627	Armature Over Voltage Status	RO	Off..On	Off	
G2.36	14628	Motor Over Speed Status	RO	Off..On	Off	
G2.37	14629	Armature Voltage Feedback Offset	RW	-100..100	0	
G2.38	14630	Armature Voltage Feedback Gain	RW	90.00..110.00%	100.00%	
G2.39	14631	Tachometer Feedback Offset	RW	-100..100	0	
G2.40	14632	Tachometer Feedback Gain	RW	0.00..300.00%	100.00%	
H1.01	16513	Logic Select	ICR	Mom..Maint1..Maint2	Maintained1	
H1.02	16514	Start-Run Forward	RW	Off..On	Off	
H1.03	16515	/Stop-Run Reverse	RW	Off..On	On	
H1.04	16516	Jog-Jog Forward	RW	Off..On	Off	
H1.05	16517	Reverse-Jog Reverse	RW	Off..On	Off	
H1.06	16518	Jog Delay	RW	0.0..10.0Secs	3.0Secs	
H1.07	16519	Safe Start Mode	ICR	Disabled..Enabled	Disabled	
H1.08	16520	/Coast Stop	RW	Off..On	On	
H1.09	16521	/Quick Stop	RW	Off..On	On	
H1.10	16522	/Dynamic Brake Stop	RW	Off..On	On	
H1.11	16523	Run Overrides Jog	RW	Disabled..Enabled	Disabled	
H1.12	16524	External Run Enable	RW	Disabled..Enabled	Disabled	
H1.13	16525	Run Status	RO	Off..On	Off	
H1.14	16526	Jog Status	RO	Off..On	Off	
H1.15	16527	Direction Status	RO	Fwd..Rev	Fwd	
H1.16	16528	Armature Pilot	RO	Off..On	Off	
H1.17	16529	Ref Enable	RO	Disabled..Enabled	Disabled	
H1.18	16530	Ramp Enable	RO	Disabled..Enabled	Disabled	
H1.19	16531	Loop Enable	RO	Disabled..Enabled	Disabled	
H1.20	16532	Drive Mode	RO	Refer to page 40	-	
H1.21	16533	Internal Ref Select	RO	A..B..C..D..Jog..Local	A	
H2.01	16641	In Local Mode	ICR	Off..On	Off	
H2.02	16642	Local Options	ICR	Refer to page 41	LSS/LREF	
H2.03	16643	Local Run Cmd	RO	Off..On	Off	
H2.04	16644	Local Jog Cmd	RO	Off..On	Off	
H2.05	16645	Local Direction Cmd	RO	Fwd..Rev	Fwd	
H2.06	16646	Local Remote Button Enable	ICR	Disabled..Enabled	Enabled	
H2.07	16647	Dir Button Enable	ICR	Disabled..Enabled	Enabled	

Tag	Modbus Address	Parameter Name	Access	Range	Preset	Note
I1.01	18561	Auxiliary Reference Enable	RW	Disabled..Enabled	Enabled	
I1.02	18562	Reference Select (MSB)	RW	Off..On	Off	
I1.03	18563	Reference Select (LSB)	RW	Off..On	Off	
I1.04	18564	Reference A	RW	-300.00%..300.00%	0.00%	
I1.05	18565	Reference B	RW	-300.00%..300.00%	10.00%	
I1.06	18566	Reference C	RW	-300.00%..300.00%	15.00%	
I1.07	18567	Reference D	RW	-300.00%..300.00%	20.00%	
I1.08	18568	Jog Reference	RW	-300.00%..300.00%	5.00%	
I1.09	18569	Local Reference	RW	-300.00%..300.00%	0.00%	
I1.10	18570	Reference	RO	-300.00%..300.00%	0.00%	
I2.01	18689	Multiplier A	RW	-300.00%..300.00%	100.00%	
I2.02	18690	Setpoint B	RW	-300.00%..300.00%	0.00%	
I2.03	18691	Multiplier B	RW	-300.00%..300.00%	100.00%	
I2.04	18692	Setpoint C	RW	-300.00%..300.00%	0.00%	
I2.05	18693	Multiplier C	RW	-300.00%..300.00%	100.00%	
I2.06	18694	Setpoint D	RW	-300.00%..300.00%	0.00%	
I2.07	18695	Multiplier D	RW	-300.00%..300.00%	100.00%	
J1.01	20609	A: Forward Accel Time	RW	0.1..600.0Secs	5.0Secs	
J1.02	20610	A: Forward Decel Time	RW	0.1..600.0Secs	5.0Secs	
J1.03	20611	A: Reverse Accel Time	RW	0.1..600.0Secs	5.0Secs	
J1.04	20612	A: Reverse Decel Time	RW	0.1..600.0Secs	5.0Secs	
J1.05	20613	A: S Accel Start Time	RW	0.0..10.0Secs	0.0Secs	
J1.06	20614	A: S Accel End Time	RW	0.0..10.0Secs	0.0Secs	
J1.07	20615	A: S Decel Start Time	RW	0.0..10.0Secs	0.0Secs	
J1.08	20616	A: S Decel End Time	RW	0.0..10.0Secs	0.0Secs	
J1.09	20617	B: Forward Accel Time	RW	0.1..600.0Secs	5.0Secs	
J1.10	20618	B: Forward Decel Time	RW	0.1..600.0Secs	5.0Secs	
J1.11	20619	B: Reverse Accel Time	RW	0.1..600.0Secs	5.0Secs	
J1.12	20620	B: Reverse Decel Time	RW	0.1..600.0Secs	5.0Secs	
J1.13	20621	B: S Accel Start Time	RW	0.0..10.0Secs	0.0Secs	
J1.14	20622	B: S Accel End Time	RW	0.0..10.0Secs	0.0Secs	
J1.15	20623	B: S Decel Start Time	RW	0.0..10.0Secs	0.0Secs	
J1.16	20624	B: S Decel End Time	RW	0.0..10.0Secs	0.0Secs	
J1.17	20625	Ramp Select	RW	A..B	A	
J1.18	20626	Ramp Bypass	RW	Off..On	Off	
J1.19	20627	Ramp Threshold	RW	0.00..100.00%	1.00%	
J1.20	20628	Ramp Input	RO	-300.00%..300.00%	0.00%	
J1.21	20629	Ramp Output	RO	-300.00%..300.00%	0.00%	
J1.22	20630	Ramping Status	RO	Off..On	Off	
J2.01	20737	A: Forward Accel Time	RW	0.1..600.0Secs	5.0Secs	
J2.02	20738	A: Forward Decel Time	RW	0.1..600.0Secs	5.0Secs	
J2.03	20739	A: Reverse Accel Time	RW	0.1..600.0Secs	5.0Secs	
J2.04	20740	A: Reverse Decel Time	RW	0.1..600.0Secs	5.0Secs	
J2.05	20741	A: S Accel Start Time	RW	0.0..10.0Secs	0.0Secs	
J2.06	20742	A: S Accel End Time	RW	0.0..10.0Secs	0.0Secs	
J2.07	20743	A: S Decel Start Time	RW	0.0..10.0Secs	0.0Secs	
J2.08	20744	A: S Decel End Time	RW	0.0..10.0Secs	0.0Secs	
J2.09	20745	B: Forward Accel Time	RW	0.1..600.0Secs	5.0Secs	
J2.10	20746	B: Forward Decel Time	RW	0.1..600.0Secs	5.0Secs	
J2.11	20747	B: Reverse Accel Time	RW	0.1..600.0Secs	5.0Secs	
J2.12	20748	B: Reverse Decel Time	RW	0.1..600.0Secs	5.0Secs	
J2.13	20749	B: S Accel Start Time	RW	0.0..10.0Secs	0.0Secs	
J2.14	20750	B: S Accel End Time	RW	0.0..10.0Secs	0.0Secs	
J2.15	20751	B: S Decel Start Time	RW	0.0..10.0Secs	0.0Secs	
J2.16	20752	B: S Decel End Time	RW	0.0..10.0Secs	0.0Secs	
J2.17	20753	Ramp Select	RW	A..B	A	
J2.18	20754	Ramp Bypass	RW	Off..On	Off	
J2.19	20755	Ramp Threshold	RW	0.00..100.00%	1.00%	
J2.20	20756	Ramp Input	RW	-300.00%..300.00%	0.00%	
J2.21	20757	Ramp Output	RO	-300.00%..300.00%	0.00%	
J2.22	20758	Ramping Status	RO	Off..On	Off	
J2.23	20759	Ramping Enable	RW	Disabled..Enabled	Enabled	
K1.01	22657	Feedback Loss Enable	RW	Disabled..Enabled	Enabled	
K1.02	22658	Feedback Loss Level	RW	0.00..100.00%	55.00%	
K1.11	22667	Armature I Foldback Time	RW	0.0..60.0Secs	15.0Secs	

Tag	Modbus Address	Parameter Name	Access	Range	Preset	Note
K1.12	22668	Armature Overcurrent Time	RW	0.0..240.0Secs	45.0Secs	
K1.13	22669	Motor Overspeed Level	RW	0.00..125.00%	125.00%	
K1.14	22670	External Fault	RW	Off..On	Off	
K1.15	22671	External Fault Reset	RW	Off..On	Off	
K1.16	22672	Software Fault Reset	RW	Off..On	Off	
K1.17	22673	Keypad Disconnect Fault Enable	RW	Disabled..Enabled	Disabled	
K2.01	22785	Power On Reset	RO	Off..On	On	
K2.02	22786	Internal Fault Reset	RO	Off..On	Off	
K2.03	22787	Active Fault Register 1	RO	0..65535	0	
K2.04	22788	Active Fault Register 2	RO	0..65535	0	
K2.05	22789	Latched Faults Register 1	RO	0..65535	0	
K2.06	22790	Latched Faults Register 2	RO	0..65535	0	
K2.07	22791	Fault Code	RO	Refer to page 90	None	
K2.08	22792	Drive Faulted	RO	No..Yes	No	
K2.10	22794	Drive Ready	RO	No..Yes	No	
K2.11	22795	Active Alarms Register 1	RO	0..65535	0	
K2.12	22796	Active Alarms Register 2	RO	0..65535	0	
K2.13	22797	Alarm Code	RO	Refer to page 51	None	
K3.01	22913	Most Recent Fault	RO	Refer to page 90	None	
K3.02	22914	2nd Most Recent Fault	RO	Refer to page 90	None	
K3.03	22915	3rd Most Recent Fault	RO	Refer to page 90	None	
K3.04	22916	4th Most Recent Fault	RO	Refer to page 90	None	
K3.05	22917	5th Most Recent Fault	RO	Refer to page 90	None	
K3.06	22918	6th Most Recent Fault	RO	Refer to page 90	None	
K3.07	22919	7th Most Recent Fault	RO	Refer to page 90	None	
K3.08	22920	8th Most Recent Fault	RO	Refer to page 90	None	
K3.09	22921	9th Most Recent Fault	RO	Refer to page 90	None	
K3.10	22922	10th Most Recent Fault	RO	Refer to page 90	None	
K3.11	22923	Clear Fault Log	RW	No..Yes	No	
K4.01	23041	Fault	RO	Refer to page 90	None	
K4.02	23042	Armature Volts	RO	-600..600V	0V	
K4.03	23043	Armature Amps	RO	Varies by Model	0A	
K4.04	23044	Field Volts	RO	0..400	0V	
K4.05	23045	Field Amps	RO	Varies by Model	0A	
K4.06	23046	Reference	RO	-300.00..300.00%	0.00%	
K4.07	23047	Ramp Output	RO	-300.00..300.00%	0.00%	
K4.08	23048	Final Velocity Demand	RO	-105.00..105.00%	0.00%	
K4.09	23049	Velocity Feedback	RO	-125.00..125.00%	0.00%	
K4.10	23050	Final Armature Current Demand	RO	-150.00..150.00%	0.00%	
K4.11	23051	Armature Current Feedback	RO	-150.00..150.00%	0.00%	
K4.12	23052	Conduction	RO	-100.00..100.00%	0.00%	
K4.16	23056	Drive Mode	RO	Refer to page 40	-	
K4.17	23057	Clear Fault Capture	RW	No..Yes	No	
L1.01	24705	PID Enable	RW	Disabled..Enabled	Disabled	
L1.02	24706	PID Reset	RW	Off..On	Off	
L1.03	24707	Proportional Gain	RW	0.00..50.00	5.00	
L1.04	24708	Integral Time	RW	0.010..60.000Secs	10.000Secs	
L1.05	24709	Derivative Gain	RW	0.000..50.000	0.000	
L1.06	24710	Deadband	RW	0.00..30.00%	0.00%	
L1.07	24711	Integral Clamp	RW	Off..On	Off	
L1.08	24712	Integral Hold	RW	Off..On	Off	
L1.09	24713	Integral Mode	RW	Classical..Linear	Linear	
L1.10	24714	Max Output	RW	0.00..100.00%	100.00%	
L1.11	24715	Min Output	RW	-100.00..0.00%	-100.00%	
L1.12	24716	Controller Action	RW	Err=Sp-Fb..Err=Fb-Sp	Err=Sp-Fb	
L1.13	24717	Setpoint	RW	-100.00..100.00%	0.00%	
L1.14	24718	Feedback	RW	-100.00..100.00%	0.00%	
L1.15	24719	Error	RO	-300.00..300.00%	0.00%	
L1.16	24720	Proportional Status	RO	-100.00..100.00%	0.00%	
L1.17	24721	Integral Status	RO	-100.00..100.00%	0.00%	
L1.18	24722	Derivative Status	RO	-100.00..100.00%	0.00%	
L1.19	24723	PID Saturation	RO	Off..On	Off	
L1.20	24724	Initial PID Output	RO	-100.00..100.00%	0.00%	
L1.21	24725	PID Trim	RW	-100.00..100.00%	10.00%	
L1.22	24726	Trim Output	RO	-100.00..100.00%	0.00%	

Tag	Modbus Address	Parameter Name	Access	Range	Preset	Note
L1.23	24727	PID Scale	RW	-100.00..100.00%	0.00%	
L1.24	24728	PID Min Scale	RW	-100.00..100.00%	10.00%	
L1.25	24729	Output	RO	-100.00..100.00%	0.00%	
L2.01	24833	Diameter Select	ICR	None..Ext..Roll..Line..L/R	None	
L2.02	24834	Core Diameter	RW	0.01..600.00"	1.00"	
L2.03	24835	Max Diameter	RW	0.01..600.00"	10.00"	
L2.04	24836	Material Thickness	RW	0.0001..6.0000"	0.0001"	
L2.05	24837	Revolutions	RW	0..65535	0	
L2.06	24838	Circumference	RW	0.01..300.00"	0.01"	
L2.07	24839	External Diameter Ratio	RW	0.00..100.00%	0.00%	
L2.08	24840	External Roll Speed	RW	-100.00..100.00%	0.00%	
L2.09	24841	Core Speed	RW	0.00..100.00%	0.00%	
L2.10	24842	Effective Roll Speed	RO	0.00..100.00%	0.00%	
L2.11	24843	Diameter Memory	RW	Disabled..Enabled	Disabled	
L2.12	24844	Core/Dia Ratio	RO	0.00..100.00%	0.00%	
L2.13	24845	Diameter/Max Ratio	RO	0.00..100.00%	0.00%	
L2.14	24846	Diameter	RO	0.00..600.00"	1.00"	
L3.01	24961	Line Speed	RW	-100.00..100.00%	0.00%	
L3.02	24962	Line Speed Sum	RW	-100.00..100.00%	0.00%	
L3.03	24963	Roll Speed Sum	RW	-100.00..100.00%	0.00%	
L3.04	24964	Roll Speed	RO	-100.00..100.00%	0.00%	
L4.01	25089	Tension Setpoint	RW	0.00..100.00%	0.00%	
L4.02	25090	Taper Diameter	RW	0.01..600.00"	600.00"	
L4.03	25091	Taper Percentage	RW	0.00..100.00%	0.00%	
L4.04	25092	Tension Demand	RO	0.00..100.00%	0.00%	
L5.01	25217	Diameter Torque Gain	RW	0.00..300.00%	100.00%	
L5.02	25218	Diameter Torque	RO	0.00..100.00%	0.00%	
L5.03	25219	Inertia Mode	RW	Accel..Decel	Accel	
L5.04	25220	Inertia Sensitivity	RW	1..10	5	
L5.05	25221	Inertia Compensation	RW	0.00..100.00%	0.00%	
L5.06	25222	Line Speed Status	RO	Decel..AtSpeed..Accel	AtSpeed	
L5.07	25223	Inertia Torque	RO	0.00..100.00%	0.00%	
L5.08	25224	Friction Compensation	RW	0.00..100.00%	0.00%	
L5.09	25225	Friction Torque	RO	0.00..100.00%	0.00%	
L5.10	25226	Static Friction Torque	RW	0.00..100.00%	0.00%	
L5.11	25227	Pulse Threshold	RW	0.00..100.00%	0.00%	
L5.12	25228	Pulse Torque Level	RW	0.00..100.00%	0.00%	
L5.13	25229	Pulse Torque Time	RW	0.0..10.0Secs	0.5Secs	
L5.14	25230	Pulse Torque	RO	0.00..100.00%	0.00%	
L5.15	25231	Torque Sum	RW	0.00..100.00%	0.00%	
L5.16	25232	Total Torque	RO	0.00..100.00%	0.00%	
L6.01	25345	MOP Increase	RW	Off..On	Off	
L6.02	25346	MOP Decrease	RW	Off..On	Off	
L6.03	25347	MOP Increase Time	RW	0.1..600.0Secs	10.0Secs	
L6.04	25348	MOP Decrease Time	RW	0.1..600.0Secs	10.0Secs	
L6.05	25349	MOP Max Value	RW	-300.00..300.00%	100.00%	
L6.06	25350	MOP Min Value	RW	-300.00..300.00%	0.00%	
L6.07	25351	MOP Reset	RW	Off..On	Off	
L6.08	25352	MOP Reset Value	RW	-300.00..300.00%	0.00%	
L6.09	25353	MOP Output	RO	-300.00..300.00%	0.00%	
M1.01	26753	Threshold 1 Input	RW	-300.00..300.00%	0.00%	
M1.02	26754	Threshold 1 Absolute Value	RW	Off..On	Off	
M1.03	26755	Threshold 1 On Level	RW	-300.00..300.00%	50.00%	
M1.04	26756	Threshold 1 Off Level	RW	-300.00..300.00%	40.00%	
M1.05	26757	Threshold 1 On Value	RW	-300.00..300.00%	100.00%	
M1.06	26758	Threshold 1 Off Value	RW	-300.00..300.00%	0.00%	
M1.07	26759	Threshold 1 Status	RO	Off..On	Off	
M1.08	26760	Threshold 1 Output	RO	-300.00..300.00%	0.00%	
M2.01	26881	Threshold 2 Input	RW	-300.00..300.00%	0.00%	
M2.02	26882	Threshold 2 Absolute Value	RW	Off..On	Off	
M2.03	26883	Threshold 2 On Level	RW	-300.00..300.00%	50.00%	
M2.04	26884	Threshold 2 Off Level	RW	-300.00..300.00%	40.00%	
M2.05	26885	Threshold 2 On Value	RW	-300.00..300.00%	100.00%	

Tag	Modbus Address	Parameter Name	Access	Range	Preset	Note
M2.06	26886	Threshold 2 Off Value	RW	-300.00..300.00%	0.00%	
M2.07	26887	Threshold 2 Status	RO	Off..On	Off	
M2.08	26888	Threshold 2 Output	RO	-300.00..300.00%	0.00%	
M3.01	27009	Threshold 3 Input	RW	-300.00..300.00%	0.00%	
M3.02	27010	Threshold 3 Absolute Value	RW	Off..On	Off	
M3.03	27011	Threshold 3 On Level	RW	-300.00..300.00%	50.00%	
M3.04	27012	Threshold 3 Off Level	RW	-300.00..300.00%	40.00%	
M3.05	27013	Threshold 3 On Value	RW	-300.00..300.00%	100.00%	
M3.06	27014	Threshold 3 Off Value	RW	-300.00..300.00%	0.00%	
M3.07	27015	Threshold 3 Status	RO	Off..On	Off	
M3.08	27016	Threshold 3 Output	RO	-300.00..300.00%	0.00%	
M4.01	27137	Threshold 4 Input	RW	-300.00..300.00%	0.00%	
M4.02	27138	Threshold 4 Absolute Value	RW	Off..On	Off	
M4.03	27139	Threshold 4 On Level	RW	-300.00..300.00%	50.00%	
M4.04	27140	Threshold 4 Off Level	RW	-300.00..300.00%	40.00%	
M4.05	27141	Threshold 4 On Value	RW	-300.00..300.00%	100.00%	
M4.06	27142	Threshold 4 Off Value	RW	-300.00..300.00%	0.00%	
M4.07	27143	Threshold 4 Status	RO	Off..On	Off	
M4.08	27144	Threshold 4 Output	RO	-300.00..300.00%	0.00%	
M5.01	27265	Threshold 5 Input	RW	-300.00..300.00%	0.00%	
M5.02	27266	Threshold 5 Absolute Value	RW	Off..On	Off	
M5.03	27267	Threshold 5 On Level	RW	-300.00..300.00%	50.00%	
M5.04	27268	Threshold 5 Off Level	RW	-300.00..300.00%	40.00%	
M5.05	27269	Threshold 5 On Value	RW	-300.00..300.00%	100.00%	
M5.06	27270	Threshold 5 Off Value	RW	-300.00..300.00%	0.00%	
M5.07	27270	Threshold 5 Status	RO	Off..On	Off	
M5.08	27272	Threshold 5 Output	RO	-300.00..300.00%	0.00%	
M6.01	27393	Threshold 6 Input	RW	-300.00..300.00%	0.00%	
M6.02	27394	Threshold 6 Absolute Value	RW	Off..On	Off	
M6.03	27395	Threshold 6 On Level	RW	-300.00..300.00%	50.00%	
M6.04	27396	Threshold 6 Off Level	RW	-300.00..300.00%	40.00%	
M6.05	27397	Threshold 6 On Value	RW	-300.00..300.00%	100.00%	
M6.06	27398	Threshold 6 Off Value	RW	-300.00..300.00%	0.00%	
M6.07	27399	Threshold 6 Status	RO	Off..On	Off	
M6.08	27400	Threshold 6 Output	RO	-300.00..300.00%	0.00%	
M7.01	27521	Threshold 7 Enable	RW	Disabled..Enabled	Disabled	
M7.02	27522	Threshold 7 Input	RW	-300.00..300.00%	0.00%	
M7.03	27523	Threshold 7 Upper Limit	RW	-300.00..300.00%	90.00%	
M7.04	27524	Threshold 7 Lower Limit	RW	-300.00..300.00%	10.00%	
M7.05	27525	Threshold 7 Delay Time	RW	0.0..60.0Secs	0.0Secs	
M7.06	27526	Threshold 7 Reset Mode	RW	Manual..Auto	Manual	
M7.07	27527	Threshold 7 Manual Reset	RW	Off..On	Off	
M7.08	27528	Threshold 7 Upper Limit Exceeded	RO	Off..On	Off	
M7.09	27529	Threshold 7 Lower Limit Exceeded	RO	Off..On	Off	
M7.10	27530	Threshold 7 Limit Exceeded	RO	Off..On	Off	
M8.01	27649	Threshold 8 Enable	RW	Disabled..Enabled	Disabled	
M8.02	27650	Threshold 8 Input	RW	-300.00..300.00%	0.00%	
M8.03	27651	Threshold 8 Upper Limit	RW	-300.00..300.00%	90.00%	
M8.04	27652	Threshold 8 Lower Limit	RW	-300.00..300.00%	10.00%	
M8.05	27653	Threshold 8 Delay Time	RW	0.0..60.0Secs	0.0Secs	
M8.06	27654	Threshold 8 Reset Mode	RW	Manual..Auto	Manual	
M8.07	27655	Threshold 8 Manual Reset	RW	Off..On	Off	
M8.08	27656	Threshold 8 Upper Limit Exceeded	RO	Off..On	Off	
M8.09	27657	Threshold 8 Lower Limit Exceeded	RO	Off..On	Off	
M8.10	27658	Threshold 8 Limit Exceeded	RO	Off..On	Off	
N1.01	28801	Timer 1 Mode	RW	Refer to page 65	OnDelay	
N1.02	28802	Timer 1 Input	RW	Off..On	Off	
N1.03	28803	Timer 1 Delay Time 1	RW	0.1..600.0Secs	5.0Secs	
N1.04	28804	Timer 1 Delay Time 2	RW	0.1..600.0Secs	5.0Secs	
N1.05	28805	Timer 1 On Value	RW	-300.00..300.00%	100.00%	
N1.06	28806	Timer 1 Off Value	RW	-300.00..300.00%	0.00%	
N1.07	28807	Timer 1 Status	RO	Stopped..Timing	Stopped	
N1.08	28808	Timer 1 Time	RO	0.0..600.0Secs	0.0Secs	

Tag	Modbus Address	Parameter Name	Access	Range	Preset	Note
N1.09	28809	Timer 1 Output Status	RO	Off..On	Off	
N1.10	28810	Timer 1 Output	RO	-300.00..300.00%	0.00%	
N2.01	28929	Timer 2 Mode	RW	Refer to page 65	OnDelay	
N2.02	28930	Timer 2 Input	RW	Off..On	Off	
N2.03	28931	Timer 2 Delay Time 1	RW	0.1..600.0Secs	5.0Secs	
N2.04	28932	Timer 2 Delay Time 2	RW	0.1..600.0Secs	5.0Secs	
N2.05	28933	Timer 2 On Value	RW	-300.00..300.00%	100.00%	
N2.06	28934	Timer 2 Off Value	RW	-300.00..300.00%	0.00%	
N2.07	28935	Timer 2 Status	RO	Stopped..Timing	Stopped	
N2.08	28936	Timer 2 Time	RO	0.0..600.0Secs	0.0Secs	
N2.09	28937	Timer 2 Output Status	RO	Off..On	Off	
N2.10	28938	Timer 2 Output	RO	-300.00..300.00%	0.00%	
N3.01	29057	Timer 3 Mode	RW	Refer to page 65	OnDelay	
N3.02	29058	Timer 3 Input	RW	Off..On	Off	
N3.03	29059	Timer 3 Delay Time 1	RW	0.1..600.0Secs	5.0Secs	
N3.04	29060	Timer 3 Delay Time 2	RW	0.1..600.0Secs	5.0Secs	
N3.05	29061	Timer 3 On Value	RW	-300.00..300.00%	100.00%	
N3.06	29062	Timer 3 Off Value	RW	-300.00..300.00%	0.00%	
N3.07	29063	Timer 3 Status	RO	Stopped..Timing	Stopped	
N3.08	29064	Timer 3 Time	RO	0.0..600.0Secs	0.0Secs	
N3.09	29065	Timer 3 Output Status	RO	Off..On	Off	
N3.10	29066	Timer 3 Output	RO	-300.00..300.00%	0.00%	
N4.01	29185	Timer 4 Mode	RW	Refer to page 65	OnDelay	
N4.02	29186	Timer 4 Input	RW	Off..On	Off	
N4.03	29187	Timer 4 Delay Time 1	RW	0.1..600.0Secs	5.0Secs	
N4.04	29188	Timer 4 Delay Time 2	RW	0.1..600.0Secs	5.0Secs	
N4.05	29189	Timer 4 On Value	RW	-300.00..300.00%	100.00%	
N4.06	29190	Timer 4 Off Value	RW	-300.00..300.00%	0.00%	
N4.07	29191	Timer 4 Status	RO	Stopped..Timing	Stopped	
N4.08	29192	Timer 4 Time	RO	0.0..600.0Secs	0.0Secs	
N4.09	29193	Timer 4 Output Status	RO	Off..On	Off	
N4.10	29194	Timer 4 Output	RO	-300.00..300.00%	0.00%	
N5.01	29313	Timer 5 Mode	RW	Refer to page 65	OnDelay	
N5.02	29314	Timer 5 Input	RW	Off..On	Off	
N5.03	29315	Timer 5 Delay Time 1	RW	0.1..600.0Secs	5.0Secs	
N5.04	29316	Timer 5 Delay Time 2	RW	0.1..600.0Secs	5.0Secs	
N5.05	29317	Timer 5 On Value	RW	-300.00..300.00%	100.00%	
N5.06	29318	Timer 5 Off Value	RW	-300.00..300.00%	0.00%	
N5.07	29319	Timer 5 Status	RO	Stopped..Timing	Stopped	
N5.08	29320	Timer 5 Time	RO	0.0..600.0Secs	0.0Secs	
N5.09	29321	Timer 5 Output Status	RO	Off..On	Off	
N5.10	29322	Timer 5 Output	RO	-300.00..300.00%	0.00%	
N6.01	29441	Timer 6 Mode	RW	Refer to page 65	OnDelay	
N6.02	29442	Timer 6 Input	RW	Off..On	Off	
N6.03	29443	Timer 6 Delay Time 1	RW	0.1..600.0Secs	5.0Secs	
N6.04	29444	Timer 6 Delay Time 2	RW	0.1..600.0Secs	5.0Secs	
N6.05	29445	Timer 6 On Value	RW	-300.00..300.00%	100.00%	
N6.06	29446	Timer 6 Off Value	RW	-300.00..300.00%	0.00%	
N6.07	29447	Timer 6 Status	RO	Stopped..Timing	Stopped	
N6.08	29448	Timer 6 Time	RO	0.0..600.0Secs	0.0Secs	
N6.09	29449	Timer 6 Output Status	RO	Off..On	Off	
N6.10	29450	Timer 6 Output	RO	-300.00..300.00%	0.00%	
O1.01	30849	Logic Gate 1 Mode	RW	Refer to page 67	A and B	
O1.02	30850	Logic Gate 1 Input A	RW	Varies by Mode	False	
O1.03	30851	Logic Gate 1 Input B	RW	Varies by Mode	False	
O1.04	30852	Logic Gate 1 Output	RO	Varies by Mode	False	
O2.01	30977	Logic Gate 2 Mode	RW	Refer to page 67	A and B	
O2.02	30978	Logic Gate 2 Input A	RW	Varies by Mode	False	
O2.03	30979	Logic Gate 2 Input B	RW	Varies by Mode	False	
O2.04	30980	Logic Gate 2 Output	RO	Varies by Mode	False	
O3.01	31105	Logic Gate 3 Mode	RW	Refer to page 67	A and B	

Tag	Modbus Address	Parameter Name	Access	Range	Preset	Note
O3.02	31106	Logic Gate 3 Input A	RW	Varies by Mode	False	
O3.03	31107	Logic Gate 3 Input B	RW	Varies by Mode	False	
O3.04	31108	Logic Gate 3 Output	RO	Varies by Mode	False	
O4.01	31233	Logic Gate 4 Mode	RW	Refer to page 67	A and B	
O4.02	31234	Logic Gate 4 Input A	RW	Varies by Mode	False	
O4.03	31235	Logic Gate 4 Input B	RW	Varies by Mode	False	
O4.04	31236	Logic Gate 4 Output	RO	Varies by Mode	False	
O5.01	31361	Logic Gate 5 Mode	RW	Refer to page 67	A and B	
O5.02	31362	Logic Gate 5 Input A	RW	Varies by Mode	False	
O5.03	31363	Logic Gate 5 Input B	RW	Varies by Mode	False	
O5.04	31364	Logic Gate 5 Output	RO	Varies by Mode	False	
O6.01	31489	Logic Gate 6 Mode	RW	Refer to page 67	A and B	
O6.02	31490	Logic Gate 6 Input A	RW	Varies by Mode	False	
O6.03	31491	Logic Gate 6 Input B	RW	Varies by Mode	False	
O6.04	31492	Logic Gate 6 Output	RO	Varies by Mode	False	
P1.01	32897	Logic Switch 1 Coil	RW	Off..On	Off	
P1.02	32898	Logic Switch 1 Input A	RW	-327.68..327.68%	0.00%	
P1.03	32899	Logic Switch 1 Input B	RW	-327.68..327.68%	0.00%	
P1.04	32900	Logic Switch 1 Output	RO	-327.68..327.68%	0.00%	
P2.01	33025	Logic Switch 2 Coil	RW	Off..On	Off	
P2.02	33026	Logic Switch 2 Input A	RW	-327.68..327.68%	0.00%	
P2.03	33027	Logic Switch 2 Input B	RW	-327.68..327.68%	0.00%	
P2.04	33028	Logic Switch 2 Output	RO	-327.68..327.68%	0.00%	
P3.01	33153	Logic Switch 3 Coil	RW	Off..On	Off	
P3.02	33154	Logic Switch 3 Input A	RW	-327.68..327.68%	0.00%	
P3.03	33155	Logic Switch 3 Input B	RW	-327.68..327.68%	0.00%	
P3.04	33156	Logic Switch 3 Output	RO	-327.68..327.68%	0.00%	
P4.01	33281	Logic Switch 4 Coil	RW	Off..On	Off	
P4.02	33282	Logic Switch 4 Input A	RW	-327.68..327.68%	0.00%	
P4.03	33283	Logic Switch 4 Input B	RW	-327.68..327.68%	0.00%	
P4.04	33284	Logic Switch 4 Output	RO	-327.68..327.68%	0.00%	
P5.01	33409	Logic Switch 5 Coil	RW	Off..On	Off	
P5.02	33410	Logic Switch 5 Input A	RW	-327.68..327.68%	0.00%	
P5.03	33411	Logic Switch 5 Input B	RW	-327.68..327.68%	0.00%	
P5.04	33412	Logic Switch 5 Output	RO	-327.68..327.68%	0.00%	
P6.01	33537	Logic Switch 6 Coil	RW	Off..On	Off	
P6.02	33538	Logic Switch 6 Input A	RW	-327.68..327.68%	0.00%	
P6.03	33539	Logic Switch 6 Input B	RW	-327.68..327.68%	0.00%	
P6.04	33540	Logic Switch 6 Output	RO	-327.68..327.68%	0.00%	
Q1.01	34945	Internal Link 1 Source	ICR	A1.01..U1.20	J1.21	
Q1.02	34946	Internal Link 1 Destination	ICR	A1.01..U1.20	G1.20	
Q1.03	34947	Internal Link 2 Source	ICR	A1.01..U1.20	J1.21	
Q1.04	34948	Internal Link 2 Destination	ICR	A1.01..U1.20	G1.02	
Q1.05	34949	Internal Link 3 Source	ICR	A1.01..U1.20	00.00	
Q1.06	34950	Internal Link 3 Destination	ICR	A1.01..U1.20	00.00	
Q1.07	34951	Internal Link 4 Source	ICR	A1.01..U1.20	00.00	
Q1.08	34952	Internal Link 4 Destination	ICR	A1.01..U1.20	00.00	
Q1.09	34953	Internal Link 5 Source	ICR	A1.01..U1.20	00.00	
Q1.10	34954	Internal Link 5 Destination	ICR	A1.01..U1.20	00.00	
Q1.11	34955	Internal Link 6 Source	ICR	A1.01..U1.20	00.00	
Q1.12	34956	Internal Link 6 Destination	ICR	A1.01..U1.20	00.00	
Q1.13	34957	Internal Link 7 Source	ICR	A1.01..U1.20	00.00	
Q1.14	34958	Internal Link 7 Destination	ICR	A1.01..U1.20	00.00	
Q1.15	34959	Internal Link 8 Source	ICR	A1.01..U1.20	00.00	
Q1.16	34960	Internal Link 8 Destination	ICR	A1.01..U1.20	00.00	
Q1.17	34961	Internal Link 9 Source	ICR	A1.01..U1.20	00.00	
Q1.18	34962	Internal Link 9 Destination	ICR	A1.01..U1.20	00.00	
Q1.19	34963	Internal Link 10 Source	ICR	A1.01..U1.20	00.00	
Q1.20	34964	Internal Link 10 Destination	ICR	A1.01..U1.20	00.00	

Tag	Modbus Address	Parameter Name	Access	Range	Preset	Note
Q2.01	35073	Internal Link 11 Source	ICR	A1.01..U1.20	00.00	
Q2.02	35074	Internal Link 11 Destination	ICR	A1.01..U1.20	00.00	
Q2.03	35075	Internal Link 12 Source	ICR	A1.01..U1.20	00.00	
Q2.04	35076	Internal Link 12 Destination	ICR	A1.01..U1.20	00.00	
Q2.05	35077	Internal Link 13 Source	ICR	A1.01..U1.20	00.00	
Q2.06	35078	Internal Link 13 Destination	ICR	A1.01..U1.20	00.00	
Q2.07	35079	Internal Link 14 Source	ICR	A1.01..U1.20	00.00	
Q2.08	35080	Internal Link 14 Destination	ICR	A1.01..U1.20	00.00	
Q2.09	35081	Internal Link 15 Source	ICR	A1.01..U1.20	00.00	
Q2.10	35082	Internal Link 15 Destination	ICR	A1.01..U1.20	00.00	
Q2.11	35083	Internal Link 16 Source	ICR	A1.01..U1.20	00.00	
Q2.12	35084	Internal Link 16 Destination	ICR	A1.01..U1.20	00.00	
Q2.13	35085	Internal Link 17 Source	ICR	A1.01..U1.20	00.00	
Q2.14	35086	Internal Link 17 Destination	ICR	A1.01..U1.20	00.00	
Q2.15	35087	Internal Link 18 Source	ICR	A1.01..U1.20	00.00	
Q2.16	35088	Internal Link 18 Destination	ICR	A1.01..U1.20	00.00	
Q2.17	35089	Internal Link 19 Source	ICR	A1.01..U1.20	00.00	
Q2.18	35090	Internal Link 19 Destination	ICR	A1.01..U1.20	00.00	
Q2.19	35091	Internal Link 20 Source	ICR	A1.01..U1.20	00.00	
Q2.20	35092	Internal Link 20 Destination	ICR	A1.01..U1.20	00.00	
Q3.01	35201	Internal Link 21 Source	ICR	A1.01..U1.20	00.00	
Q3.02	35202	Internal Link 21 Destination	ICR	A1.01..U1.20	00.00	
Q3.03	35203	Internal Link 22 Source	ICR	A1.01..U1.20	00.00	
Q3.04	35204	Internal Link 22 Destination	ICR	A1.01..U1.20	00.00	
Q3.05	35205	Internal Link 23 Source	ICR	A1.01..U1.20	00.00	
Q3.06	35206	Internal Link 23 Destination	ICR	A1.01..U1.20	00.00	
Q3.07	35207	Internal Link 24 Source	ICR	A1.01..U1.20	00.00	
Q3.08	35208	Internal Link 24 Destination	ICR	A1.01..U1.20	00.00	
Q3.09	35209	Internal Link 25 Source	ICR	A1.01..U1.20	00.00	
Q3.10	35210	Internal Link 25 Destination	ICR	A1.01..U1.20	00.00	
Q3.11	35211	Internal Link 26 Source	ICR	A1.01..U1.20	00.00	
Q3.12	35212	Internal Link 26 Destination	ICR	A1.01..U1.20	00.00	
Q3.13	35213	Internal Link 27 Source	ICR	A1.01..U1.20	00.00	
Q3.14	35214	Internal Link 27 Destination	ICR	A1.01..U1.20	00.00	
Q3.15	35215	Internal Link 28 Source	ICR	A1.01..U1.20	00.00	
Q3.16	35216	Internal Link 28 Destination	ICR	A1.01..U1.20	00.00	
Q3.17	35217	Internal Link 29 Source	ICR	A1.01..U1.20	00.00	
Q3.18	35218	Internal Link 29 Destination	ICR	A1.01..U1.20	00.00	
Q3.19	35219	Internal Link 30 Source	ICR	A1.01..U1.20	00.00	
Q3.20	35220	Internal Link 30 Destination	ICR	A1.01..U1.20	00.00	
R1.01	36993	Clear Counters	RW	Off..On	Off	
R1.02	36994	Bus Message Count	RO	0..65535	0	
R1.03	36995	Bus Com Error Count	RO	0..65535	0	
R1.04	36996	Bus Exception Error Count	RO	0..65535	0	
R1.05	36997	Device Message Count	RO	0..65535	0	
R1.06	36998	Device No Response Count	RO	0..65535	0	
R1.07	36999	Break Detected Count	RO	0..65535	0	
R1.08	37000	Framing Error Count	RO	0..65535	0	
R1.09	37001	Overrun Error Count	RO	0..65535	0	
R1.10	37002	Parity Error Count	RO	0..65535	0	
R2.01	37249	Modbus Address	RW	1..247	1	
R2.02	37250	Baud Rate	RW	2400..115200	38400	
R2.03	37251	Parity	RW	None..Odd..Even	None	
R2.04	37252	Stop Bits	RW	1..2	2	
R2.05	37253	Apply	RW	Off..On	Off	
R2.06	37254	Clear Counters	RW	Off..On	Off	
R2.07	37255	Bus Message Count	RO	0..65535	0	
R2.08	37256	Bus Com Error Count	RO	0..65535	0	
R2.09	37257	Bus Exception Error Count	RO	0..65535	0	
R2.10	37258	Device Message Count	RO	0..65535	0	
R2.11	37259	Device No Response Count	RO	0..65535	0	
R2.12	37260	Break Detected Count	RO	0..65535	0	
R2.13	37261	Framing Error Count	RO	0..65535	0	
R2.14	37262	Overrun Error Count	RO	0..65535	0	
R2.15	37263	Parity Error Count	RO	0..65535	0	
R2.16	37264	Timeout Enable	RW	Disabled..Enabled	Disabled	

Tag	Modbus Address	Parameter Name	Access	Range	Preset	Note
R2.17	37265	Timeout Period	RW	0.0..20.0Secs	0.5Secs	
R2.18	37266	Timeout Action	RW	None..Alarm..Fault	None	
R2.19	37267	Timeout Status	RO	Error..OK	Error	
R2.20	37268	Ethernet Address Mode	RW	Auto..Manual	Auto	
R2.21	37269	IP Address 1	RW	0..255	0	
R2.22	37270	IP Address 2	RW	0..255	0	
R2.23	37271	IP Address 3	RW	0..255	0	
R2.24	37272	IP Address 4	RW	0..255	0	
R2.25	37273	Subnet Mask 1	RW	0..255	0	
R2.26	37274	Subnet Mask 2	RW	0..255	0	
R2.27	37275	Subnet Mask 3	RW	0..255	0	
R2.28	37276	Subnet Mask 4	RW	0..255	0	
R2.29	37277	Gateway Address 1	RW	0..255	0	
R2.30	37278	Gateway Address 2	RW	0..255	0	
R2.31	37279	Gateway Address 3	RW	0..255	0	
R2.32	37280	Gateway Address 4	RW	0..255	0	
R2.33	37281	TCP Client Connected Status	RO	0..1	0	
R4.01	37377	Port ID	RO	0..65535	0	
R4.02	37378	Keypad Status	RO	Offline..Online	Online	
S1.01	39041	Zero Speed Setpoint	RW	0.50..25.00%	4.00%	
S1.02	39042	Standstill Enable	RW	Disabled..Enabled	Enabled	
S1.03	39043	Standstill Timer	RW	0.0..10.0Secs	0.1Secs	
S1.04	39044	At Zero Set	RO	Off..On	Off	
S1.05	39045	At Zero Demand	RO	Off..On	Off	
S1.06	39046	At Zero Speed	RO	Off..On	Off	
S1.07	39047	At Standstill	RO	Off..On	Off	
T1.01	41089	Drive Model	RO	Varies by Model	-	
T1.02	41090	Drive Rated Armature Current	RO	Varies by Model	-	
T1.04	41092	Drive Firmware Version	RO	Varies by Model	-	
T1.08	41096	Edit In Progress	RO	Off..On	Off	
T1.09	41097	Reset Source	RO	0x0000..0xFFFF	-	
T1.15	41103	EEPROM Fault Status	RO	No Fault..Read..Write	No Fault	
T1.16	41104	EEPROM Alarm Status	RO	Refer to page 76	0	
T1.17	41105	Option Board ID Raw	RO	0..4095	0	
T1.18	41106	Option Board ID	RO	-	0	
T2.01	41217	Parameter Save	RW	Off..On	Off	
T2.02	41218	Line Frequency Select	ICR	Auto..50..60	Auto	
T2.03	41219	Line Frequency Status	RO	0..60Hz	0Hz	
T2.04	41220	Regen Enable	ICR	Disabled..Enabled	Enabled	
U1.01	43137	Aux 1	RW	-327.68..327.67%	0.00%	
U1.02	43138	Aux 2	RW	-327.68..327.67%	0.00%	
U1.03	43139	Aux 3	RW	-327.68..327.67%	0.00%	
U1.04	43140	Aux 4	RW	-327.68..327.67%	0.00%	
U1.05	43141	Aux 5	RW	-327.68..327.67%	0.00%	
U1.06	43142	Aux 6	RW	-327.68..327.67%	0.00%	
U1.07	43143	Aux 7	RW	-327.68..327.67%	0.00%	
U1.08	43144	Aux 8	RW	-327.68..327.67%	0.00%	
U1.09	43145	Aux 9	RW	-327.68..327.67%	0.00%	
U1.10	43146	Aux 10	RW	-327.68..327.67%	0.00%	
U1.11	43147	Aux 11	RW	-327.68..327.67%	0.00%	
U1.12	43148	Aux 12	RW	-327.68..327.67%	0.00%	
U1.13	43149	Aux 13	RW	-327.68..327.67%	0.00%	
U1.14	43150	Aux 14	RW	-327.68..327.67%	0.00%	
U1.15	43151	Aux 15	RW	-327.68..327.67%	0.00%	
U1.16	43152	Aux 16	RW	-327.68..327.67%	0.00%	
U1.17	43153	Aux 17	RW	-327.68..327.67%	0.00%	
U1.18	43154	Aux 18	RW	-327.68..327.67%	0.00%	
U1.19	43155	Aux 19	RW	-327.68..327.67%	0.00%	
U1.20	43156	Aux 20	RW	-327.68..327.67%	0.00%	

Table 19: Faults

Fault	Description	Suggested Action
EEPROM READ FAULT	The drive was unable to read the parameters from the EEPROM	Power down the drive for one minute and then re-apply power. If fault is still present, re-initialize drive by setting A1.02=9999. Note that this will reset all parameters to factory defaults. If fault persists, replace processor and/or control board.
EEPROM WRITE FAULT	An error occurred when the drive attempted to save parameters to the EEPROM.	Power down the drive for one minute and then re-apply power. If fault is still present, re-initialize drive by setting A1.02=9999. Note that this will reset all parameters to factory defaults. If fault persists, replace processor and/or control board.
INVALID MOTOR DATA	Motor data has not been entered.	Program the motor data into the drive. Refer to the F1.xx parameters.
KEYPAD DISCONNECT	The CN9 cable from the Control board to the keypad was disconnected.	Disable this fault (See K1.17). Please note that disabling this fault only applies when the drive is in remote operation. Even when disabled, this fault will still occur if the keypad is disconnected and the drive is running in local mode.
ARMATURE OVERCURRENT	The motor armature current exceeded 105% for the time period defined by K1.12.	Verify motor armature current rating and ensure F1.02 is set properly. Excessive load on motor. Reduce load on motor.
ARMATURE OVERVOLTAGE	The motor armature voltage exceeded 120% of the rated motor voltage (F1.03).	Verify motor armature voltage rating and ensure F1.03 is set properly. If an armature contactor is used, ensure contactor is energizing and contacts are working properly.

Fault	Description	Suggested Action
MOTOR OVERSPEED	The motor speed exceeded the level set by K1.13. This fault is only applicable when the drive is in tachometer or encoder feedback.	<p><u>G2.15=Tachometer</u> Verify tachometer rating. Ensure F2.02 and jumper J2 are set properly.</p> <p>Ensure proper polarity of tachometer signal (G2.11) and invert if necessary (F2.02).</p> <p><u>G2.15=Encoder</u> Verify F1.07 and F3.02 are set properly.</p>
FEEDBACK LOSS	The tachometer or encoder speed feedback signal was not detected by the drive. This fault is only applicable when the drive is in tachometer or encoder feedback.	<p><u>G2.15=Tachometer</u> Verify tachometer rating. Ensure F2.02 and jumper J2 are set properly.</p> <p>Ensure proper polarity of tachometer signal (G2.11) and invert if necessary (F2.02).</p> <p><u>G2.15=Encoder</u> Verify F1.07 and F3.02 are set properly.</p>
EXTERNAL FAULT	Parameter K1.14 momentarily became On	<p>When used, a digital input is typically linked to K1.14. Check external wiring on the digital input.</p> <p>Confirm correct logic polarity. If logic is reversed, swap the On and Off values of the digital input.</p>
COM PORT B TIMEOUT	No activity was detected on the Com B Option Port during the R2.17 time period	<p>Verify proper communications.</p> <p>Increase the R2.17 timeout period.</p> <p>Disable the fault (see R2.18).</p>

9

Spare Parts

9.1 Printed Circuit Assemblies

Control Board

All models D14605-000

Regulator Board

All models D14602-000

Power Board

All models D14599-000

Keypad Board

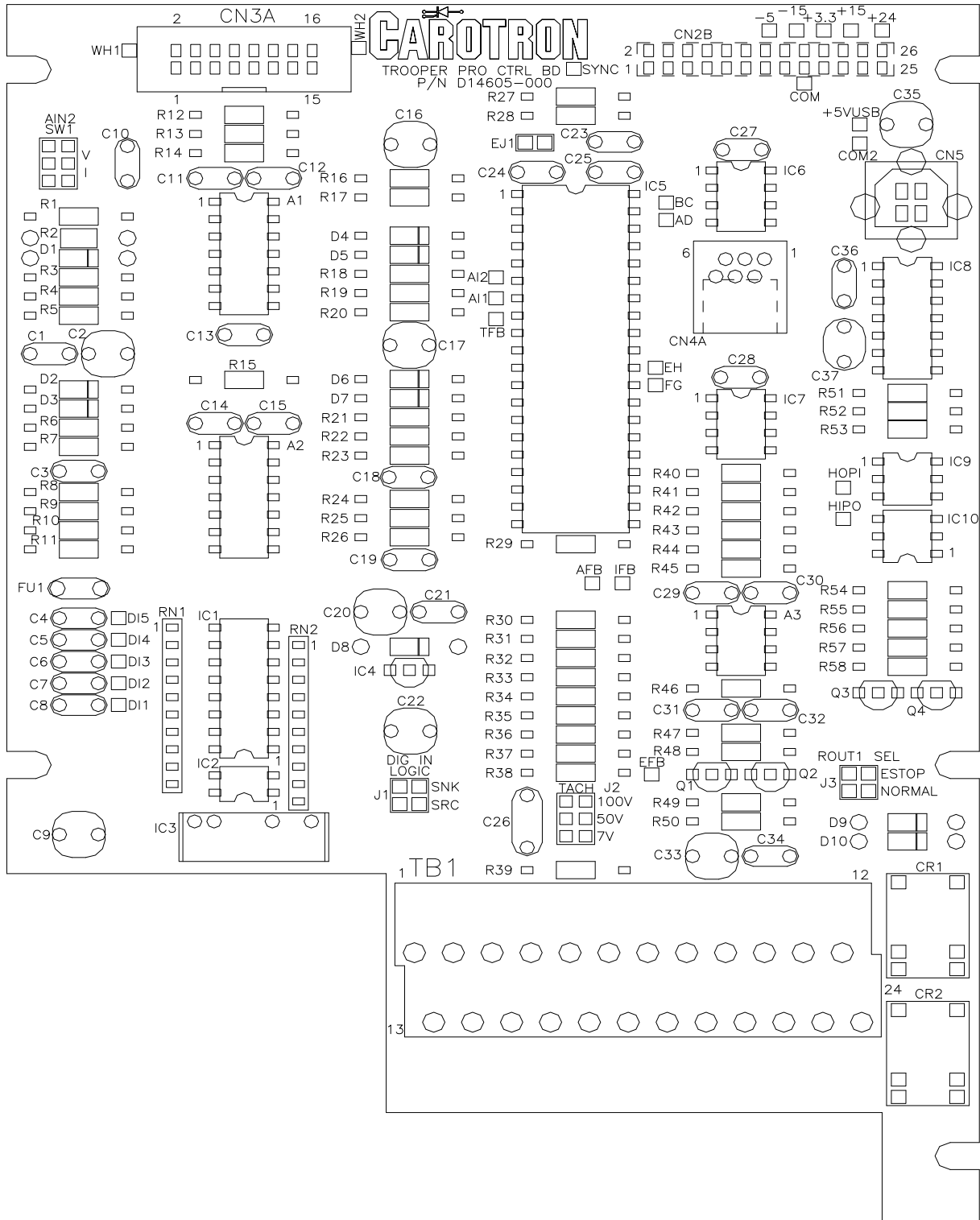
All models C14608-000

9.2 Fuses

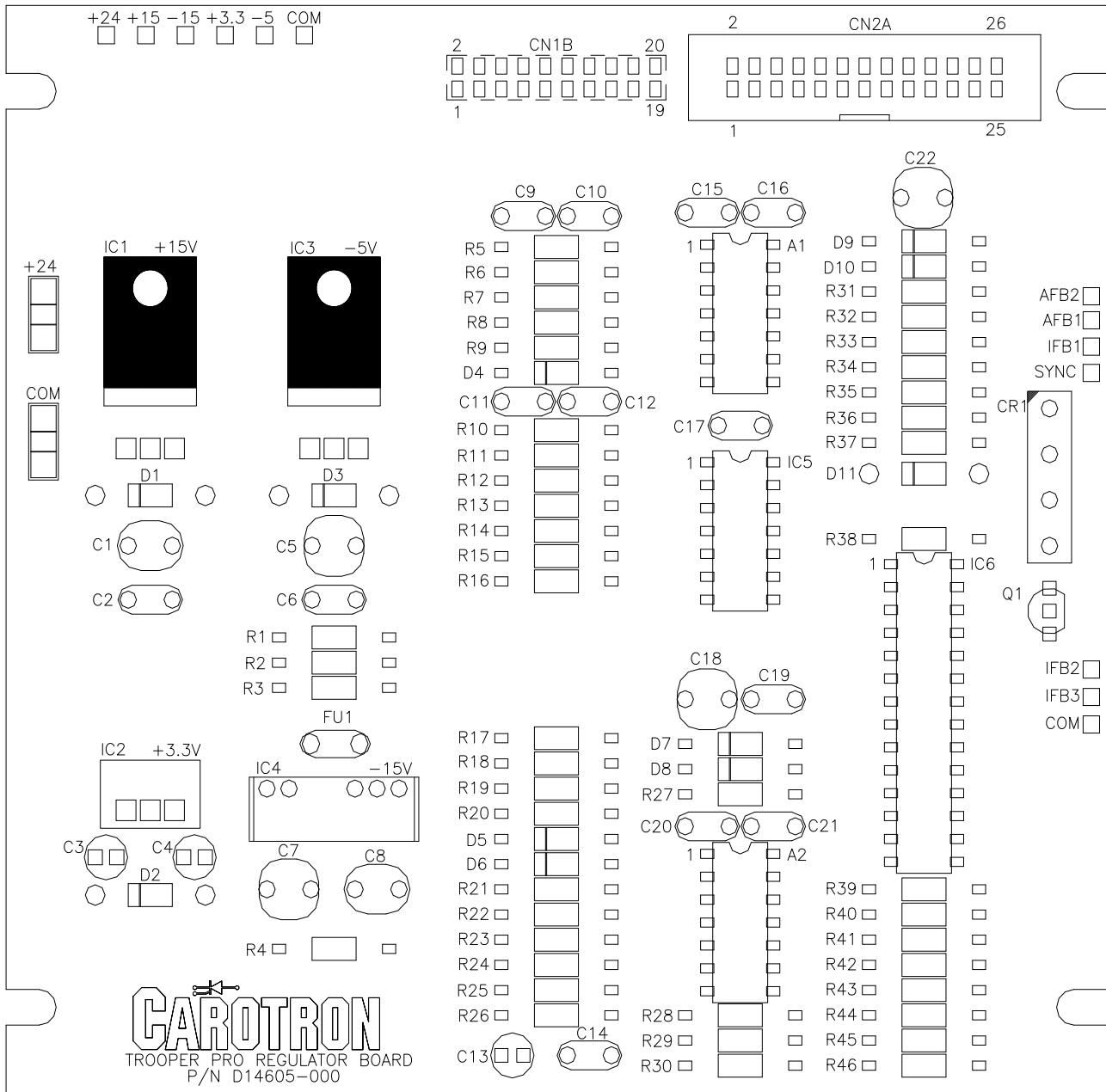
Recommended Line Fuses: Time Delay, 250VAC

Model	Amps	Carotron P/N	Manufacturer P/N
TPR002-000	15	FUS1005-00	Bussmann MDA-15 Littelfuse 326015 Mersen GSA15

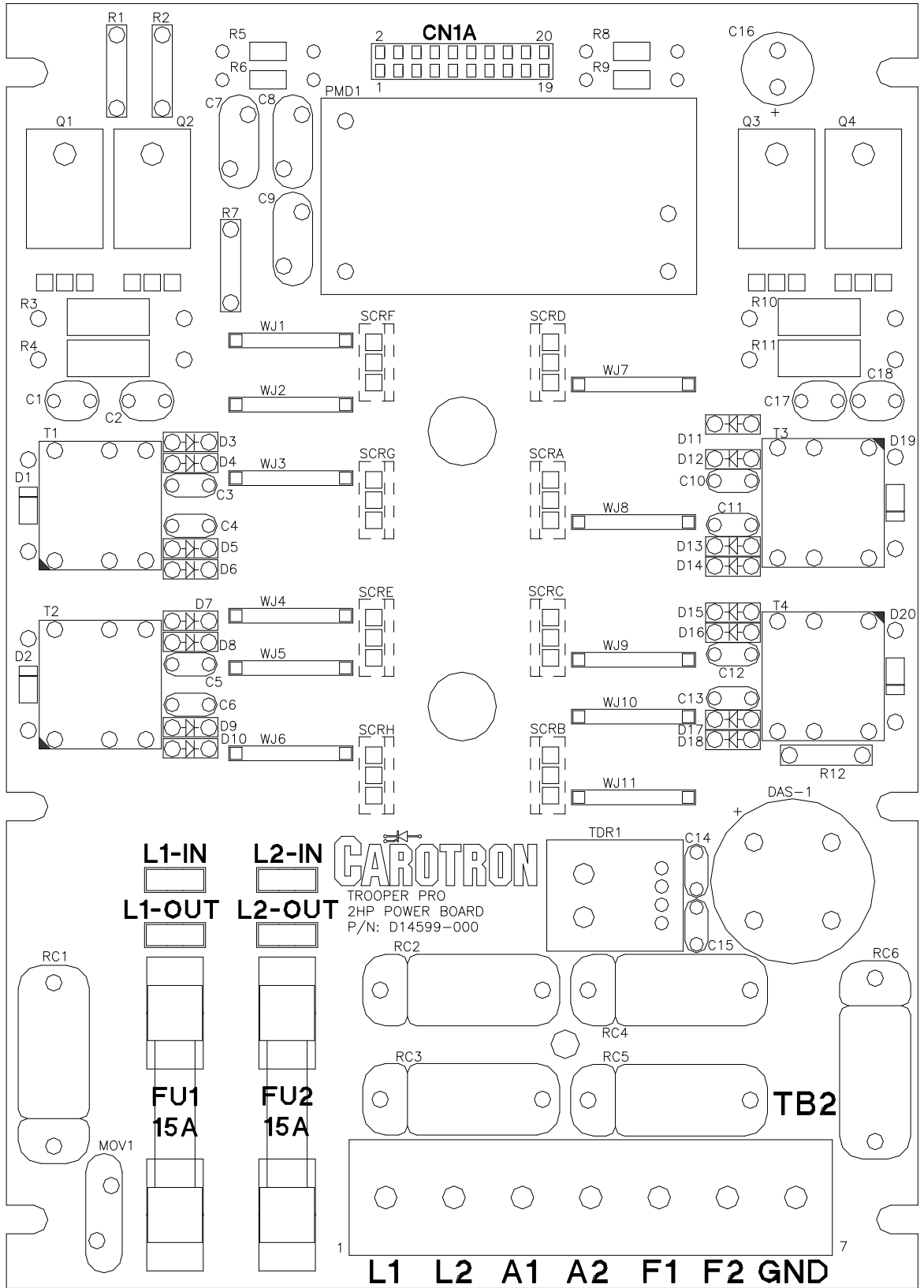
Table 20: Recommended Line Fuses



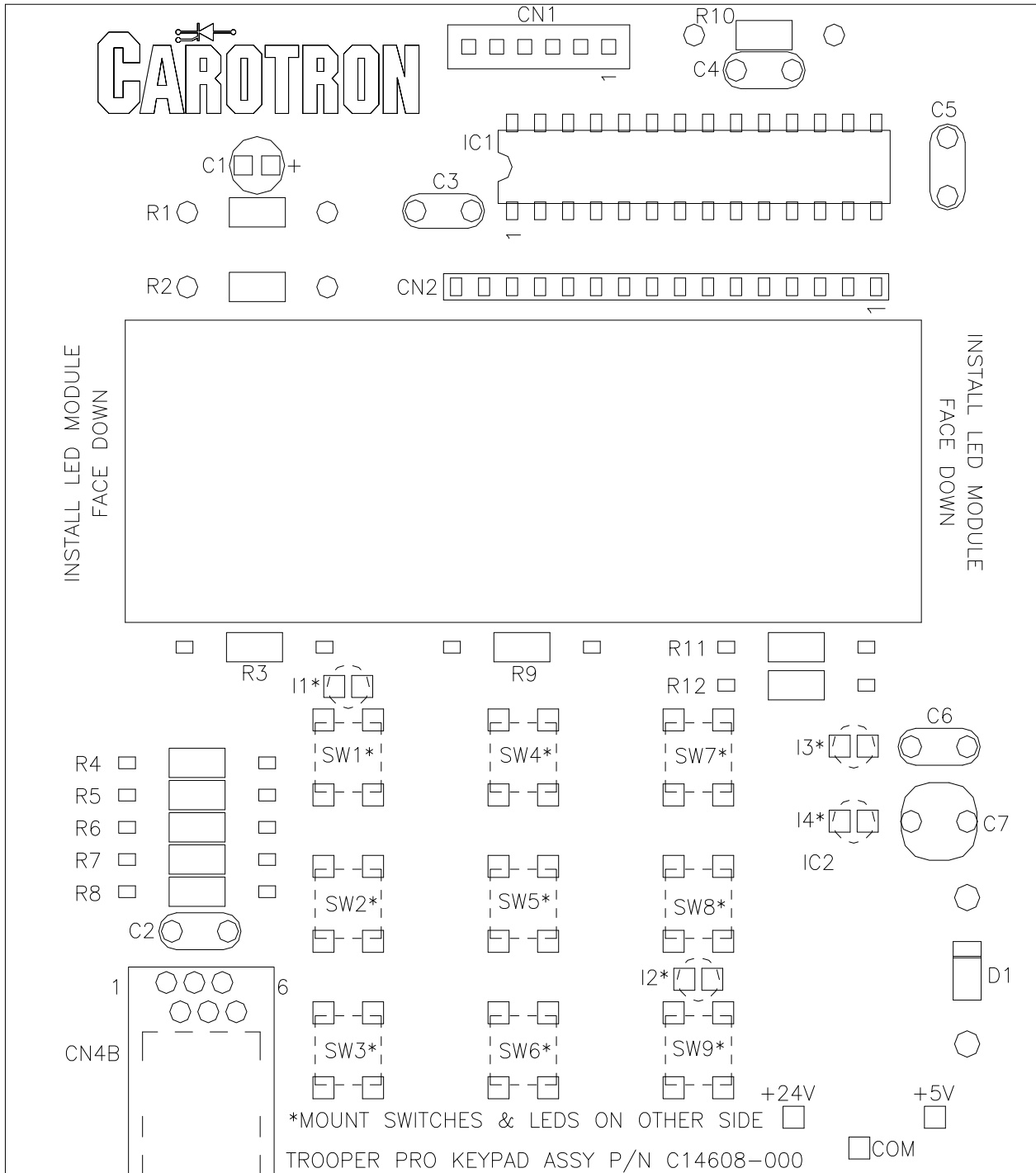
D14605 CONTROL BOARD ASSEMBLY



D14602 REGULATOR BOARD ASSEMBLY

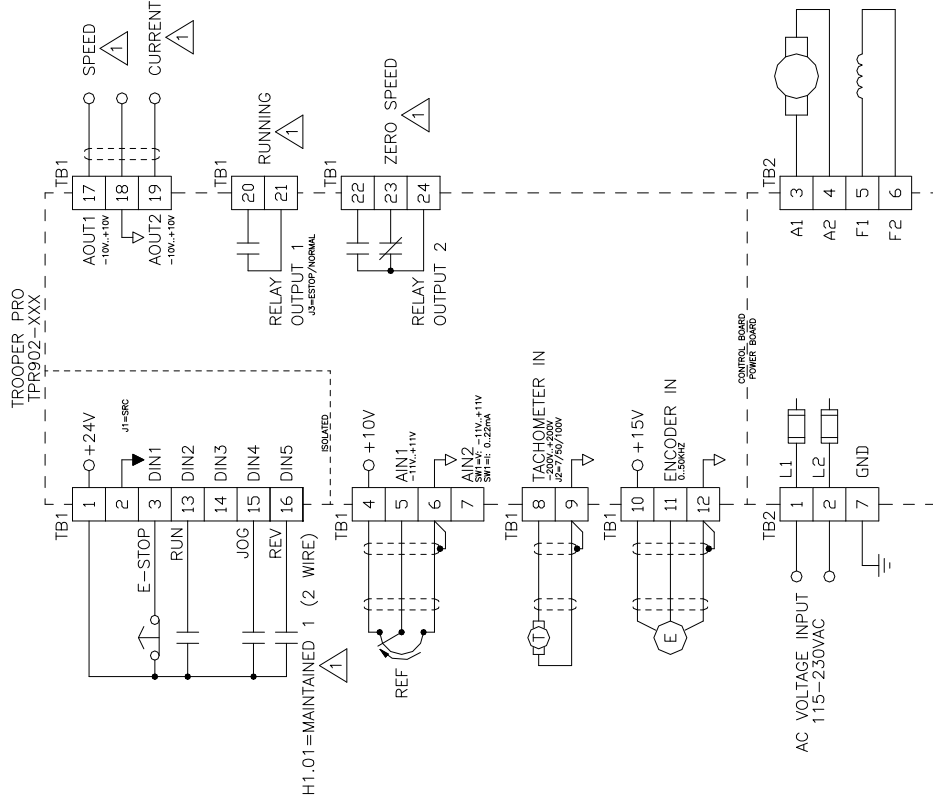
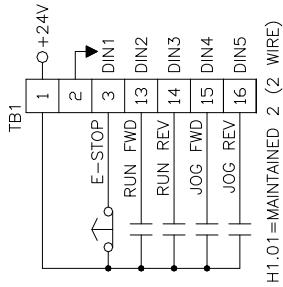
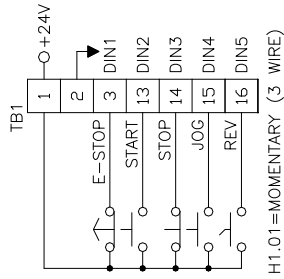


D14599 POWER BOARD ASSEMBLY



C14608 KEYPAD BOARD ASSEMBLY

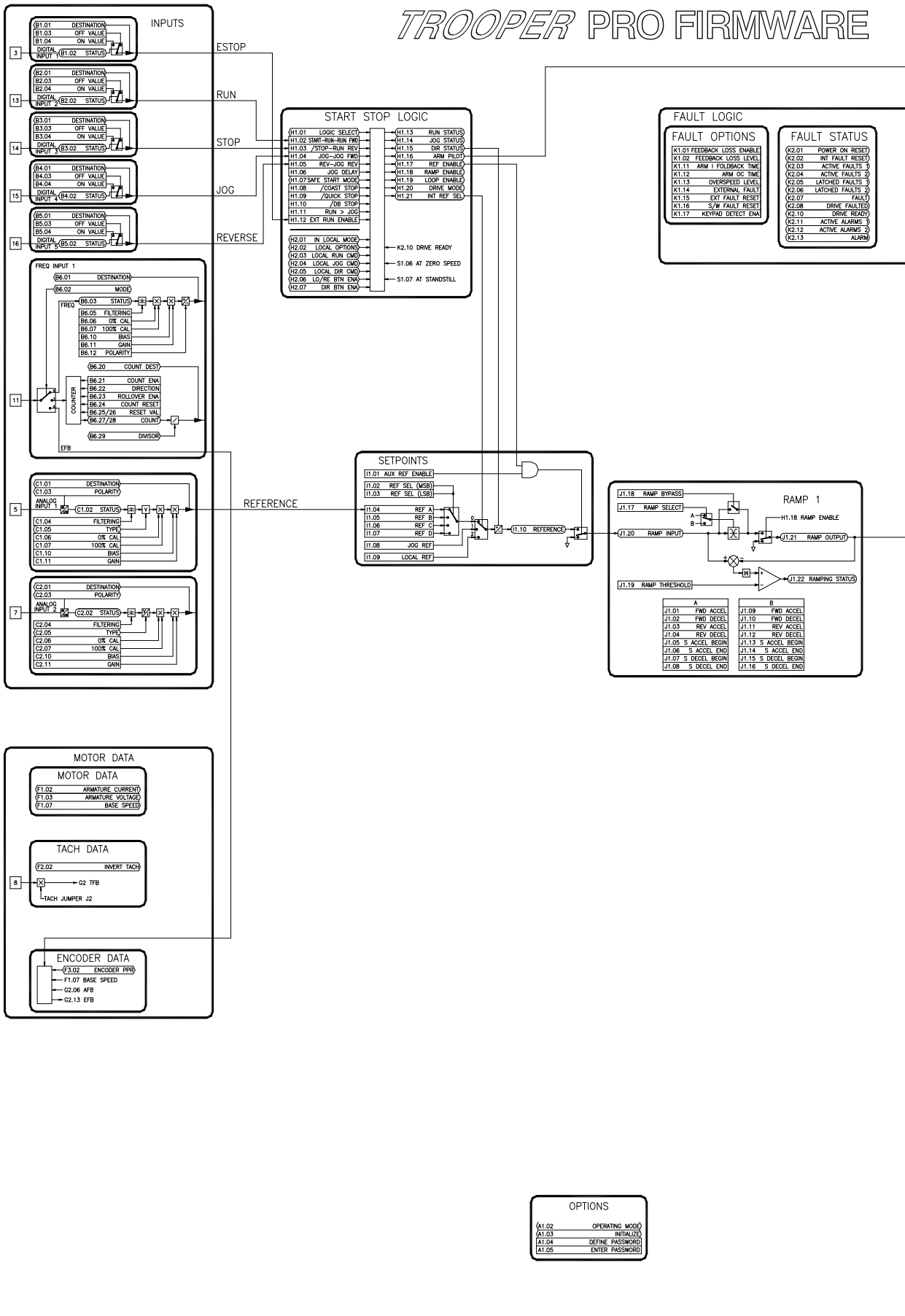
ALTERNATE DIGITAL INPUT SCHEMES



NOTES:
 DEFAULT FUNCTION SHOWN. CAN BE CHANGED VIA PROGRAMMING.

DRAWN BY: BKP		DATE: 12/10/21
APPROVED BY:		DATE:
CAROTRON <i>Driven by Excellence</i>		
HEATH SPRINGS, SC TEL 803-266-8614 FAX 803-266-8663		
TOLERANCES: 1 DEC PL. = .005 2 DEC PL. = .0025 3 DEC PL. = .001		TITLE: TROOPER PRO CONNECTION DIAGRAM TPR902-XXX
SCALE:		DRAWING NUMBER: C14701
REV. -		SH. 1 OF 1

TROOPER PRO FIRMWARE



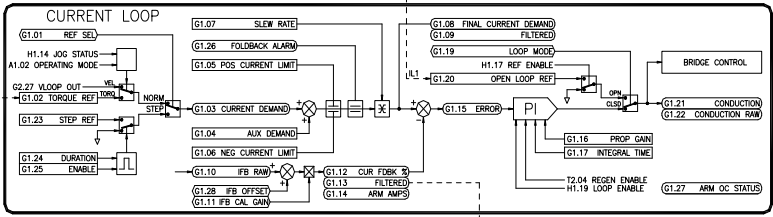
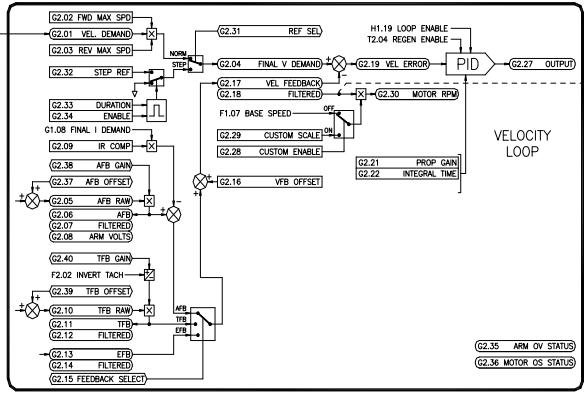
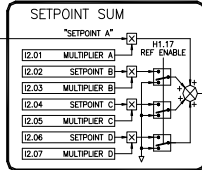
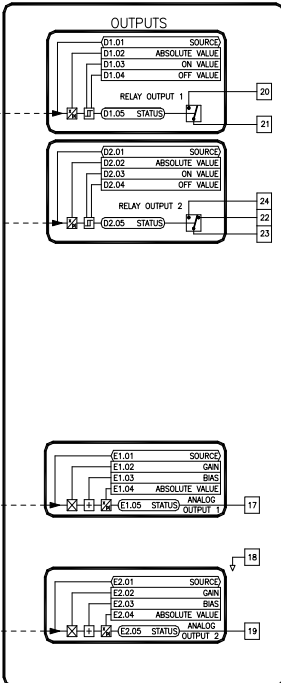
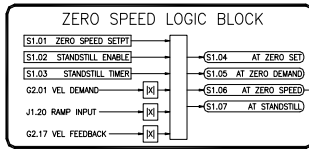
BLOCK DIAGRAM

FAULT LOG

(K3.01)	MOST RECENT FAULT
(K3.02)	2ND MOST RECENT FAULT
(K3.03)	3RD MOST RECENT FAULT
(K3.04)	4TH MOST RECENT FAULT
(K3.05)	5TH MOST RECENT FAULT
(K3.06)	6TH MOST RECENT FAULT
(K3.07)	7TH MOST RECENT FAULT
(K3.08)	8TH MOST RECENT FAULT
(K3.09)	9TH MOST RECENT FAULT
(K3.10)	10TH MOST RECENT FAULT
(K3.11)	CLEAR FAULT LOG

FAULT CAPTURE

(C4.01)	FAULT
(C4.02)	ARMATURE VOLTS
(C4.03)	ARMATURE AMPS
(C4.06)	REFERENCE
(C4.07)	RAMP OUTPUT
(C4.08)	FINAL VELOCITY DEMAND
(C4.09)	VELOCITY FEEDBACK
(C4.10)	FINAL ARM CURRENT DEMAND
(C4.11)	ARM CURRENT FEEDBACK
(C4.12)	ARMATURE CONDUCTION
(C4.16)	DRIVE MODE
(C4.17)	CLEAR FAULT CAPTURE

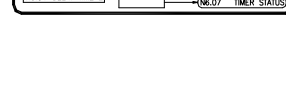
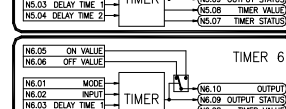
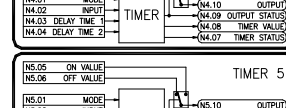
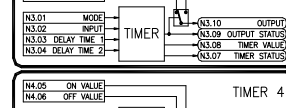
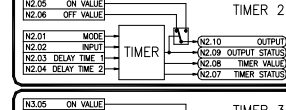
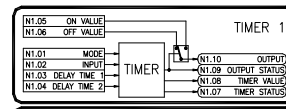
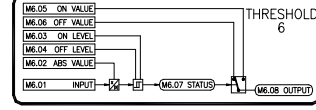
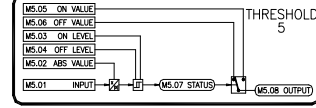
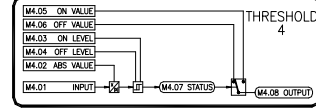
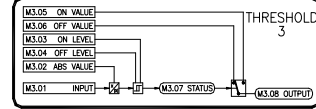
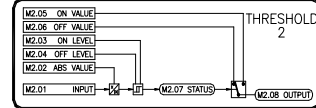
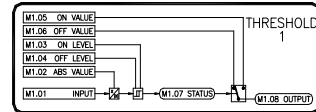
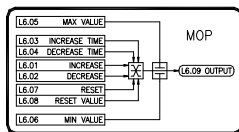
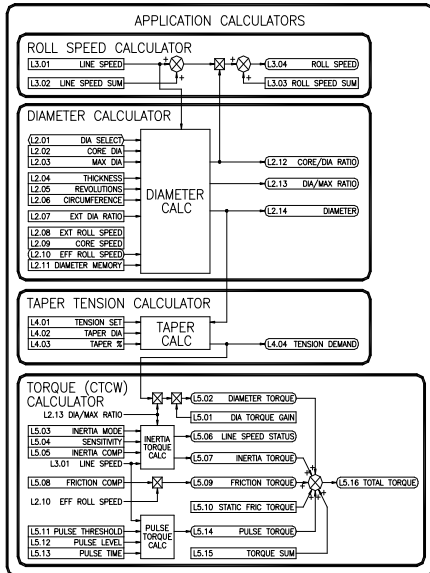
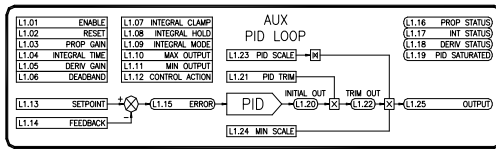
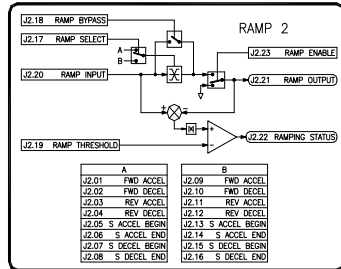


KEY

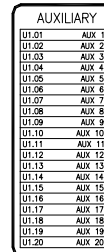
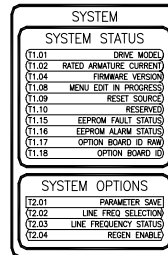
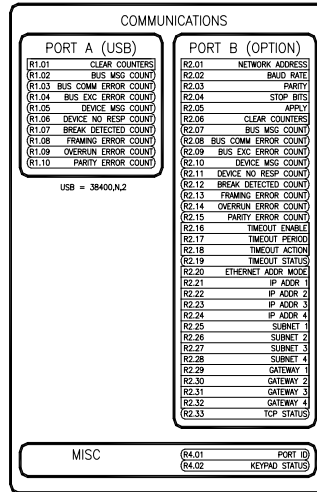
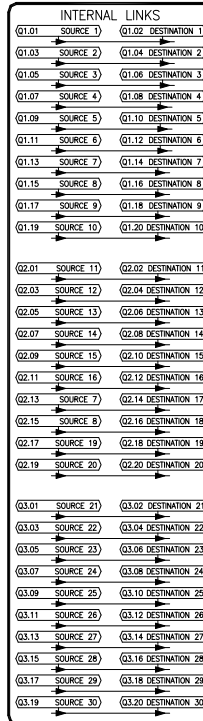
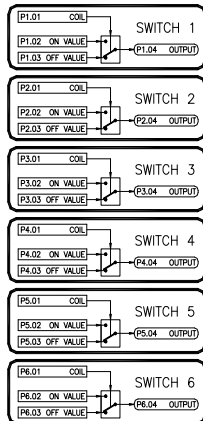
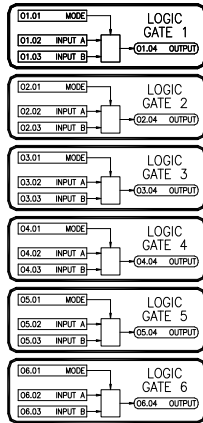
- NON-CONFIGURABLE LINK
- - - RE-CONFIGURABLE LINK
- [TAG] PARAMETER READ/WRITE PARAMETER
- (TAG) PARAMETER ICR PARAMETER
- (TAG) PARAMETER READ ONLY PARAMETER

DRAWN BY: BKP	DATE: 6/4/20	<p>Driven by Excellence</p>
APPROVED BY:	DATE:	
TOLERANCES ± 2 DEC. PL. = .010" 3 DEC. PL. = .005"		HEATH SPRINGS, SC TEL 803-286-9614 FAX 803-286-6063
SCALE:	TITLE:	TROOPER PRO FIRMWARE BLOCK DIAGRAM
DRAWING NUMBER: D14702	REV.	SH. 1 OF 2

TROOPER PRO FIRMWARE



BLOCK DIAGRAM



DRAWN BY: BKP	DATE: 6/4/20	CAROTRON <i>Driven by Excellence</i>
APPROVED BY:	DATE:	
TOLERANCES - 3 DEC. PL. = .025" 3 DEC. PL. = .005"		HEATH SPRINGS, SC TEL 803-286-8614 FAX 803-286-6463
SCALE:		
DRAWING NUMBER: D14702		TITLE: TROOPER PRO FIRMWARE BLOCK DIAGRAM
REV.		SH. 2 OF 2

Notes

Standard Terms & Conditions of Sale

1. General

The Standard Terms and Conditions of Sale of Carotron, LLC. (hereinafter called "Company") are set forth as follows in order to give the Company and the Purchaser a clear understanding thereof. No additional or different terms and conditions of sale by the Company shall be binding upon the Company unless they are expressly consented to by the Company in writing. The acceptance by the Company of any order of the Purchaser is expressly conditioned upon the Purchaser's agreement to said Standard Terms and Conditions. The acceptance or acknowledgement, written, oral, by conduct or otherwise, by the Company of the Purchaser's order shall not constitute written consent by the Company to addition to or change in said Standard Terms and Conditions.

2. Prices

Prices, discounts, allowances, services and commissions are subject to change without notice. Prices shown on any Company published price list and other published literature issued by the Company are not offers to sell and are subject to express confirmation by written quotation and acknowledgement. All orders of the Purchaser are subject to acceptance, which shall not be effective unless made in writing by an authorized Company representative at its office in Heath Springs, S.C. The Company may refuse to accept any order for any reason whatsoever without incurring any liability to the Purchaser. The Company reserves the right to correct clerical and stenographic errors at any time.

3. Shipping dates

Quotation of a shipping date by the Company is based on conditions at the date upon which the quotation is made. Any such shipping date is subject to change occasioned by agreements entered into previous to the Company's acceptance of the Purchaser's order, governmental priorities, strikes, riots, fires, the elements, explosion, war, embargoes, epidemics, quarantines, acts of God, labor troubles, delays of vendors or of transportation, inability to obtain raw materials, containers or transportation or manufacturing facilities or any other cause beyond the reasonable control of the Company. In no event shall the Company be liable for consequential damages for failure to meet any shipping date resulting from any of the above causes or any other cause.

In the event of any delay in the Purchaser's accepting shipment of products or parts in accordance with scheduled shipping dates, which delay has been requested by the Purchaser, or any such delay which has been caused by lack of shipping instructions, the Company shall store all products and parts involved at the Purchaser's risk and expense and shall invoice the Purchaser for the full contract price of such products and parts on the date scheduled for shipment or on the date on which the same is ready for delivery, whichever occurs later.

4. Warranty

The Company warrants to the Purchaser that products manufactured or parts repaired by the Company, will be free, under normal use and maintenance, from defects in material and workmanship for a period of one (1) year after the shipment date from the Company's factory to the Purchaser. The Company makes no warranty concerning products manufactured by other parties.

As the Purchaser's sole and exclusive remedy under said warranty in regard to such products and parts, including but not limited to remedy for consequential damages, the Company will at its option, repair or replace without charge any product manufactured or part repaired by it, which is found to the Company's satisfaction to be so defective; provided, however, that (a) the product or part involved is returned to the Company at the location designated by the Company, transportation charges prepaid by the Purchaser; or (b) at the Company's option the product or part will be repaired or replaced in the Purchaser's plant; and also provided that (c) the Company is notified of the defect within one (1) year after the shipment date from the Company's factory of the product or part so involved.

The Company warrants to the Purchaser that any system engineered by it and started up under the supervision of an authorized Company representative will, if properly installed, operated and maintained, perform in compliance with such system's written specifications for a period of one (1) year from the date of shipment of such system.

As the Purchaser's sole and exclusive remedy under said warrant in regard to such systems, including but not limited to remedy for

consequential damages, the Company will, at its option, cause, without charges any such system to so perform, which system is found to the Company's satisfaction to have failed to so perform, or refund to the Purchaser the purchase price paid by the Purchaser to the Company in regard thereto; provided, however, that (a) Company and its representatives are permitted to inspect and work upon the system involved during reasonable hours, and (b) the Company is notified of the failure within one (1) year after date of shipment of the system so involved.

The warranties hereunder of the Company specifically exclude and do not apply to the following:

- a. Products and parts damaged or abused in shipment without fault of the Company.
- b. Defects and failures due to operation, either intentional or otherwise, (1) above or beyond rated capacities, (2) in connection with equipment not recommended by the Company, or (3) in an otherwise improper manner.
- c. Defects and failures due to misapplication, abuse, improper installation or abnormal conditions of temperature, humidity, abrasives, dirt or corrosive matter.
- d. Products, parts and systems which have been in any way tampered with or altered by any party other than an authorized Company representative.
- e. Products, parts and systems designed by the Purchaser.
- f. Any party other than the Purchaser.

The Company makes no other warranties or representation, expressed or implied, of merchantability and of fitness for a particular purpose, in regard to products manufactured, parts repaired and systems engineered by it.

5. Terms of payment

Standard terms of payment are net thirty (30) days from date of the Company invoice. For invoice purposed, delivery shall be deemed to be complete at the time the products, parts and systems are shipped from the Company and shall not be conditioned upon the start up thereof. Amounts past due are subject to a service charge of 1.5% per month or fraction thereof.

6. Order cancellation

Any cancellation by the Purchaser of any order or contract between the Company and the Purchaser must be made in writing and receive written approval of an authorized Company representative at its office in Heath Springs, S.C. In the event of any cancellation of an order by either party, the Purchaser shall pay to the Company the reasonable costs, expenses, damages and loss of profit of the Company incurred there by, including but not limited to engineering expenses and expenses caused by commitments to the suppliers of the Company's subcontractors, as determined by the Company.

7. Changes

The Purchaser may, from time to time, but only with the written consent of an authorized Company representative, make a change in specifications to products, parts or systems covered by a purchase order accepted by the company. In the event of any such changes, the Company shall be entitled to revise its price and delivery schedule under such order.

8. Returned material


If the Purchaser desires to return any product or part, written authorization thereof must first be obtained from the Company which will advise the Purchaser of the credit to be allowed and restocking charges to be paid in regard to such return. No product or part shall be returned to the Company without a "RETURN TAG" attached thereon which has been issued by the Company.

9. Packing

Published prices and quotations include the Company's standard packing for domestic shipment. Additional expenses for special packing or overseas shipments shall be paid by the Purchaser. If the Purchaser does not specify packing or accepts parts unpacked, no allowance will be made to the Purchaser in lieu of packing.

10. Standard transportation policy

Unless expressly provided in writing to the contrary, products, parts and systems are sold f.o.b. first point of shipment. Partial shipments shall be permitted, and the Company may invoice each shipment separately. Claims for non-delivery of products, parts and systems, and for damages thereto must be filed with the carrier by the Purchaser. The Company's responsibility therefore shall cease when the carrier signs for and accepts the shipment.



CAROTRON

Driven by Excellence

D.C. DRIVES, A.C. INVERTERS,
SOLID STATE STARTERS, SYSTEM INTERFACE
CIRCUITS AND ENGINEERED SYSTEMS

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Heath Springs, SC 29058

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