

# 10 Keypad, Displays, & Drive Parameters

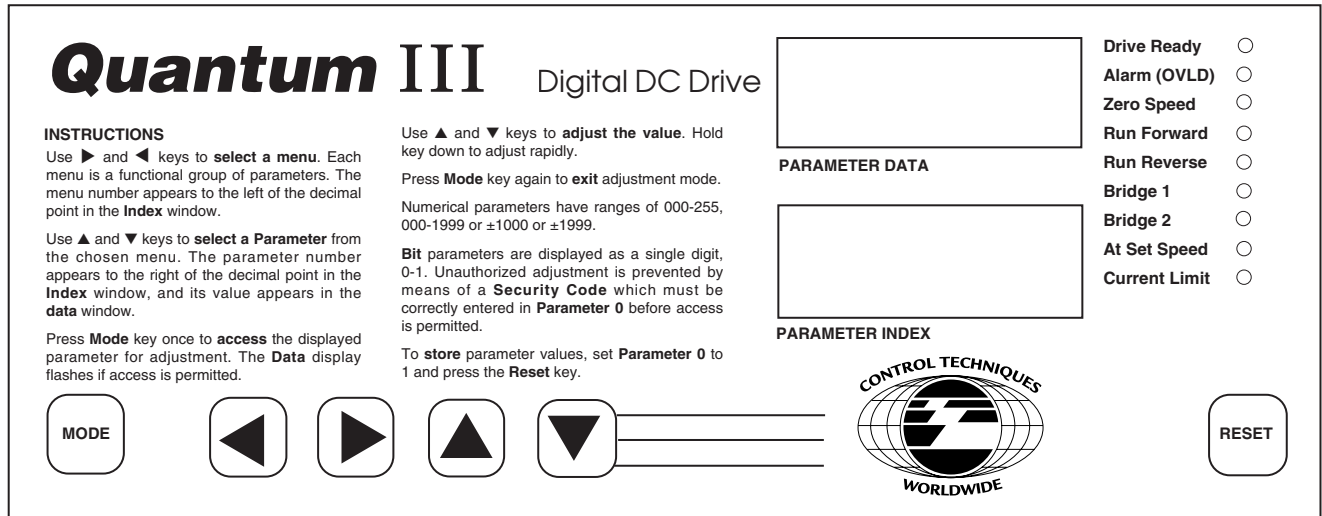


Figure 10-1.  
Quantum III Decal

## 10.1 KEYPAD

The keypad serves two purposes:

1. You can configure the drive for specific applications and change its performance in many ways, such as adjusting the times of acceleration and deceleration and presetting levels of security access.

Subject to safety considerations, adjustments may be made with the drive running or stopped. If running, the drive responds immediately to the new setting.

2. You can get full information about the settings and the operational status of the drive. Extensive diagnostic information is available in the event of a drive fault.

For parameter adjustment, the keypad has five keys. Use the ◀ or ▶ keys to select a Menu (functional group of parameters). The menu number appears to the left of the decimal point in the Index window.

Use the ▲ or ▼ keys to select a parameter from the chosen menu. The parameter number appears to the right of the decimal point in the Index window, and the value of the chosen parameter appears in the Data window.

Press the MODE key once to access the displayed parameter value for adjustment. The value flashes if access is permitted.

### NOTE

If access is not permitted, check the following:

1. The parameter is "read only."
2. The parameter is invisible and protected by a level of security (see paragraph 10.5).
3. The parameter is assigned to a programmable input.
4. The parameter is being driven by an application program with the serial interface.

Use the ▲ or ▼ keys to adjust the value. To adjust quickly, press and hold a key.

Press the MODE key again to exit from the adjustment mode.

## SAVING PARAMETERS

To store (make permanently effective) the parameter value changes, set parameter 00 of any menu = 1 and press reset. If this sequence is not enacted, the changes will be lost when the power is removed from the drive.

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## 10.2 DISPLAYS

### 1 Index

The lower four-digit display indicates menu number to the left of the (permanent) decimal point, and parameter number to the right.

### 2 Data

The upper four-digit display indicates the value of a selected parameter. The present value of each parameter, in turn, appears in the data display as parameter numbers are changed.

Numerical parameters have values in ranges of 000 to 255, 000 to +1999, or 000 to ±1000. Refer to the information starting with paragraph 10.3 for parameter unit values, e.g volts, rpm, etc.

Bit parameter values are displayed as 0 or 1, preceded by a b. The first digit for integer parameters (0 to 255) is a r .

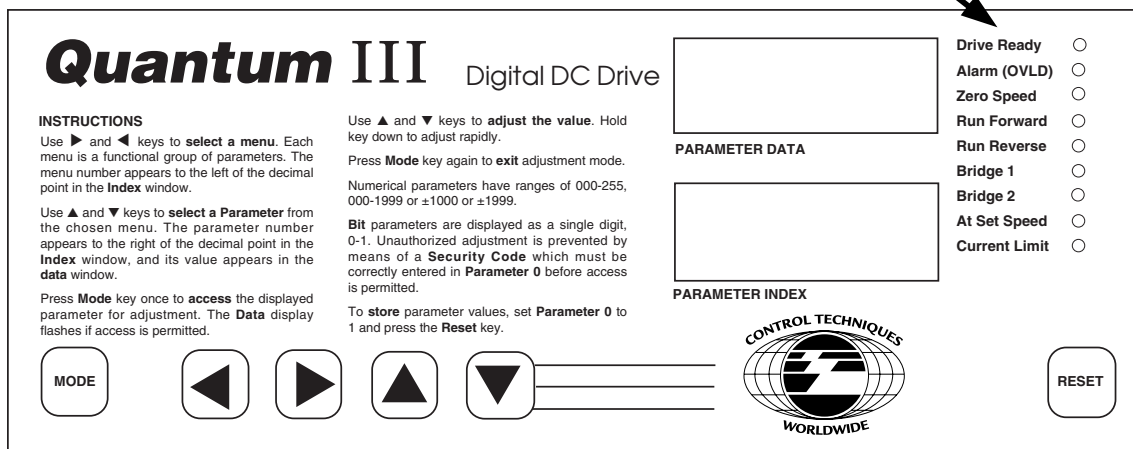
### 3 Trip Codes

If the drive faults, the index display shows “trip”, and the data message will flash. The data display shows a mnemonic to indicate the reason for the fault. These are explained in Section 13, “Fault Finding.”

### 4 Status Indicators

Nine LEDs to the right of the parameter data and index panels present information, continuously updated, about the running condition of the drive and enable basic information to be seen at a glance.

LED ILLUMINATED	INFORMATION
Drive ready	The drive is turned on, not tripped.
Drive ready — flashing	The drive is tripped.
Alarm — flashing	The drive is in an overload trip condition or is integrating in the I x t region.
Zero speed	Motor speed < zero speed threshold (programmable).
Run forward	Motor running forward.
Run reverse	Motor running in reverse.
Bridge 1	Output bridge 1 is enabled.
Bridge 2	Output bridge 2 is enabled. (inactive in 1-quad drives).
At speed	Motor running at the speed demanded by the speed reference.
Current limit	Drive running and delivering maximum permitted current.



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## 10.3 DRIVE PARAMETERS

The list of menus is given in paragraph 10.6. Parameter names, ranges, default values and security are given in paragraph 10.6.2. A full description and explanation, when required, is found in paragraph 10.7. Block diagrams are shown for each menu in Figures 10-4 through 10-18.

Before attempting to adjust parameters, please refer to paragraph 10.1 for details on keypad entry and paragraph 10.5 for details on security.

## 10.4 TYPES OF PARAMETERS

### Real Values:

A real value parameter has a numerical value and can be unipolar or bipolar. Its range can be from -1999 to +1999. Real values are comparable to potentiometers in analog drives, but are much more precise and not subject to drift. They are used to set variables such as speed, acceleration, or current limit.

### Bit Values:

A bit value is one which can have a value of either 1 or 0 and is therefore reserved for drive status variables which are either true or false, enabled or disabled, etc. Bit values are used to represent such variables as quadrant enable, ramp enable, drive at speed, etc.

Each parameter falls into one of two further categories, as follows:

### Read-only values:

Read-only values are ones which are set or measured by the drive itself, either during power-up reset or continuously during drive operation. As the name implies, these values may only be read, and allows one to MONITOR ONLY drive status and performance.

### Read/Write Values:

Read/write values are those which are set by keypad entry, serial interface communication or background program execution to optimize the drive performance for a given application. Read/write values may also be monitored by means of the keypad and displays or via the serial interface to verify drive status and performance.

## 10.4.1 Visible and Invisible Parameters

The parameter set with which Quantum III drives are equipped is divided into two further groups for operational convenience.

Those which are ordinarily needed for setting the drive up at the installation and start-up stage can be called up whenever the drive is powered on. These are called the “visible” parameters.

The second group contains the “invisible” parameters, so called because at Level 1 security they do not appear in the Index display, even if called up. These are the parameters required for fine tuning a drive to operate, for example, in a process system, usually in conjunction with one or more other drives of the same or different type.

Visible and invisible parameters are distinguished in the text and in the control logic diagrams for Menus 1 to 16. Visible parameter numbers are in plain typeface, e.g. 01.01, and invisible parameters in italics, e.g. 01.01. They are also classified in paragraph 10.6.2.

### Visible Parameters

Visible parameters, both RO and R/W, are always available to read when the drive is powered on. Visible R/W parameters are normally protected by one or more levels of security and cannot be changed until the correct codes have been entered. This is Level 1 security, unless and until a higher level code is set.

### Invisible Parameters

Invisible parameters always require Level 2 security code, and will require Level 3 (if set). With the correct code(s), invisible RO parameters are accessible to read, and invisible R/W parameters are accessible to write.

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## 10.4.2 Default Values

When power is removed and then reapplied to the drive, the parameters will revert to standard power-on default values—altered by any parameter changes that have been stored. See paragraph 10.4.7. The Quantum III defaults are listed in paragraph 10.6.2.

The parameters have been set to standard settings during manufacture of the basic world-wide drive. These values differ slightly from the power-on defaults listed in paragraph 10.6.2. It may be desirable to reset the Quantum III to these values. To re-establish factory defaults, select parameter 00 of any menu, press mode, and enter 255 for factory non-regenerative defaults or 233 for factory regenerative defaults, followed by reset.

### NOTE

Drive must be in STOP condition before re-establishing defaults.

### QUANTUM III FACTORY SETTINGS

After factory defaults are reset, the following must be changed to enable the drive to function as a Quantum III.

#### Changes to Default Values:

02.13=1 (Jog Ramp)  
03.13=1 (AVF Feedback)  
03.15=500 (Max Arm Volts)  
05.19=1 (Standstill Mode on Stop)  
06.07=1000 (Cross-over Voltage)  
06.15=1 (Enable Field Economy)  
06.21=815 (Field Firing Angle Endstop)  
07.12=119 (Analog Input #2)  
07.13=120 (Analog Input #3)  
07.14=408  
08.12=111 (F2: #22=Run Permit)  
08.13=113 (F3: #23=Inch/Jog)  
08.14=112 (F4: #24=Reverse)  
08.15=115 (F5: #25=Ref #3)  
08.16=1034 (F6: #26=Ext Trip)  
08.21=1 (Disable Logic Functions)  
09.24=1 (Invert Status #ST5)  
11.01=304 Arm Volts DC  
11.02=502 Arm Amps DC  
11.03=303 Machine RPM  
11.04=102 Speed Reference  
11.05=706 AC Line Voltage  
11.06=106 Max Reference Limit  
11.07=105 Jog Speed  
11.08=204 Accel Time  
11.09=205 Decel Time  
11.10=405 Current Limit

Then save, using procedure discussed in paragraph 8.3.3.

## 10.4.3 Organization

Parameters are organized into functionally-related sets, or menus, so that access to parameters related to a specific function is logical and quick. The menus are listed in paragraph 10.6.1.

## 10.4.4 Adjustment

Any menu and any visible parameter can be selected and will display its value to read without need for a Security Code. The procedure is the same if a parameter value is to be changed, except that entering a Security Code will normally have to be the first action.

Any menu, and any invisible parameter can be selected and its value displayed to read and write when the correct security code has been entered.

Whenever the user returns to a menu (between power-on and power-off), the software immediately goes to the last parameter to have been selected in that menu. This is convenient when making a series of adjustments to a particular group of parameters.

## 10.4.5 Access to Parameters

Initially, when the drive is first powered on, and if Level 3 security is not set, access to write is immediately available to a small group of the visible parameters. Refer to paragraph 10.5.1 and Figure 10-3.

If Level 3 security is set, all parameters are always protected.

## 10.4.6 Procedure

The procedure for selecting and changing a parameter is shown in Figure 10-2 and described on the following pages. It is also described on the keypad of the Quantum III.

For most parameters, the drive accepts and uses the value entered, and the motor will respond to the new value immediately. The exception is a change of Baud Rate (11.12), Serial Mode (11.13), Threshold 1 Destination (12.07) and Threshold 2 Destination (12.12). To enable the drive to act on the change in these cases, press RESET after writing the new value.

Any new value is not saved however, and will be lost at power-off.

The keypad is ready to select another menu or parameter.

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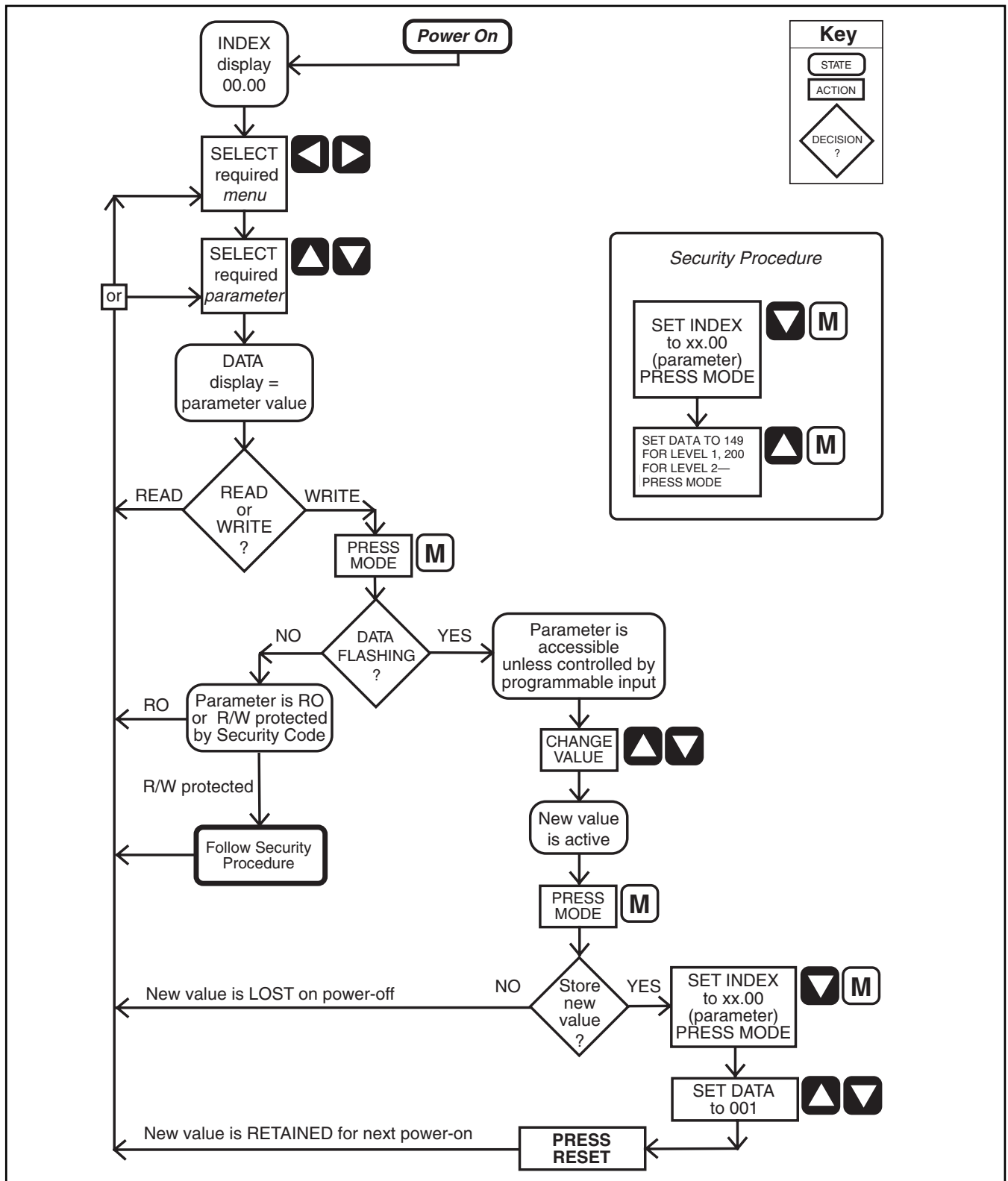


Figure 10-2.  
Adjustment of Parameters and Level 1 Security

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PROCEDURES FOR SELECTING AND CHANGING PARAMETERS		
OPERATION	KEYS	DISPLAY WINDOW
Select menu	◀ or ▶	Index, left of decimal point
Select parameter	▲ or ▼	Index, right of decimal point
Read only	—	Data
Read/Write Change value <i>only if display is flashing</i> <i>—refer to 10.5</i>	MODE, then ▲ or ▼	Data
Enter new value	MODE	Data

## 10.4.7 SAVING VALUES

The following procedure saves the values of all parameters changed since the previous save. It will function in any of the 16 menus.

To Save the Value(s) Written

PROCEDURES FOR SAVING WRITTEN VALUES		
OPERATION	KEYS	DISPLAY WINDOW
Select parameter xx.00 of any menu	▼	Index, right of decimal point
Change value to 001	MODE, then ▲ or ▼ then MODE	Data Value = 001
Store	Reset	

Value(s) saved

- If the parameter data flashes, the user can change the value UNLESS the parameter has already been configured to be controlled by a programmable input.
- If the data does not flash, either the parameter is RO or, if R/W, it is protected by security. The procedure for gaining access to parameters protected by Level 1 security is given below.

If the Level 1 security code does not afford access when applied, the parameter is protected by Level 3 security.

Visible parameters are always accessible to the user to read only. Unless the Level 1 security code is entered, most R/W parameters are not accessible to write.

A group of 24 parameters in Menus 1 to 6 plus parameters 11.01 to 11.10, are immediately accessible to write. These are listed in paragraph 10.5.1.

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### NOTE

These are not accessible if Level 3 security is set. See paragraph 10.5.5.

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## 10.5 SECURITY

After selecting a parameter number and pressing MODE:

### SECURITY PROCEDURES

#### 10.5.1 Power On

A. The following visible parameters are immediately accessible, NOT protected by Level 1 or Level 2 security.

01.05	Inch reference
01.06	Maximum speed forward
01.09	Maximum speed reverse
01.11	Reference 'ON'
01.12	REVERSE selector
01.13	INCH selector
02.04	Forward acceleration 1
02.05	Forward deceleration 1
02.06	Reverse deceleration 1
02.07	Reverse acceleration 1
03.09	Speed loop P gain (proportional)
03.10	Speed loop I gain (integral)
03.11	Speed loop D gain (differential)
03.14	Feedback encoder scaling
03.15	Maximum armature voltage
03.16	Maximum speed (scaling rpm)
03.17	IR compensation
04.05	I limit Bridge 1
04.06	I limit Bridge 2
05.05	Maximum current ( scaled )
06.06	IR compensation 2
06.07	Back-emf set point
06.08	Maximum field current 1
06.10	Minimum field current

and 11.01 to 11.10 — User Menu 00

B. Of the rest of the parameters —

- RO - (read only) parameters are accessible to be read.
- R/W - (read/write) parameters are read-only until a Level 1 security code is entered.

#### 10.5.2 Level 1 Security to Access the Visible R/W Parameters (Figure 10-2)

- Select any menu
- ▲ or ▼ to set index to zero (xx.00)
- Press **mode** **M**
- ▲ or ▼ to write 149 in data  
(Level 1 security code) - PARTIAL ACCESS
- Press **mode** **M**

Visible R/W parameters are now accessible to write new values.

#### 10.5.3 Level 2 Security to Access the Invisible R/W Parameters (Figure 10-2)

- Select any menu
- ▲ or ▼ to set index to zero (xx.00)
- Press **mode** **M**
- ▲ or ▼ to write 200 in data  
(Level 2 security code) - FULL ACCESS
- Press **mode** **M**

All R/W parameters are now accessible to write new values.

RO parameters can be read.

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#### NOTE

Level 1 and Level 2 security entry is lost when power is removed from the drive. It must be reset after each power-up.

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## 10.5.4 To Enable Free Access to ALL Parameters

A. To remove security—

- Power on
- ▲ or ▼ to set index to xx.00
- Press **mode** **M**
- ▲ or ▼ to write 200 in data (Level 2 security code)
- Press **mode** **M**
- ◀ or ▶ plus ▲ or ▼ to set index to 11.17
- Press **mode** **M**
- ▼ to write 0

If the parameters are now saved (paragraph 10.4.7), there is no protection for ANY parameter.

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### NOTE

All parameters are accessible even after power is removed and reapplied.

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B. To reinstate security—

Repeat the procedure in paragraph 10.5.4 but make parameter 11.17=149, and save (paragraph 10.4.7).

## 10.5.5 Level 3 Security

An additional private security code, Level 3, is available to the user. The code is user-programmable from 1 to 255 **except** 149 (the Level 1 code). If applied, the effect prevents access to **all** parameters until the Level 3 code has been entered prior to entering the Level 1 or Level 2 code.

A. To assign a Level 3 security code number—

- Power up
- ▲ or ▼ to set index to xx.00
- Press **mode** **M**
- ▲ or ▼ to write 200 in data (Level 2 security code)
- Press **mode** **M**
- ◀ or ▶ plus ▲ or ▼ to set index to 11.17. Data display shows 149.
- Press **mode** **M**

- ▲ or ▼ to write any 3-digit number from 1 to 255 in data (excluding 149—the Level 1 security code)

- Press **mode** **M**
- Save (paragraph 10.4.7)

There is now no access to any parameter, not even to read only, until the assigned Level 3 code has been entered.

B. Level 3 Security Access—

- ◀ or ▶ plus ▲ or ▼ to set index to xx.00
- Press **mode** **M**
- ▲ or ▼ to write the assigned code number in data (Level 3 security code)
- Press **mode** **M**

The user now has access through Level 1 and 2 Security, one of which has to be entered next.

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### CAUTION

**When Level 3 security is set, you must maintain access to your 3-digit assigned code number. If you forget or lose this number, the factory must be consulted for a means of retrieving the number.**

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See Appendix F for more details on Security.



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## 8.5.6 Basic Keypad/Display Operations

The image shows the keypad of a Quantum III Digital DC Drive. It features a central display area with two windows: 'PARAMETER DATA' and 'PARAMETER INDEX'. To the right of the display are several status LEDs: Drive ready, Alarm, Zero speed, Run forward, Run reverse, Bridge 1, Bridge 2, At speed, and Current limit. Below the display are five navigation keys: MODE, left arrow, right arrow, up arrow, and down arrow. A RESET key is located on the far right. The keypad also has a logo for 'CONTROL TECHNIQUES WORLDWIDE'.

Parameter Value Setting

INSTRUCTIONS  
Use  $\blacktriangleright$  and  $\blacktriangleleft$  keys to SELECT A MENU. Each menu is a functional group of parameters. The menu number appears to the left of the decimal point in the INDEX window.  
Use  $\uparrow$  and  $\downarrow$  keys to SELECT A PARAMETER from the chosen menu. The parameter number appears to the right of the decimal point in the INDEX window, and its value appears in the DATA window. Press MODE key once to ACCESS the displayed parameter for adjustment. The DATA display flashes if access is permitted.  
Use  $\uparrow$  and  $\downarrow$  keys to ADJUST THE VALUE. Hold key down to adjust rapidly.

Press MODE key again to EXIT adjustment mode. NUMERICAL parameters have ranges of 000 - 255, 000 - 1999,  $\pm 1000$  or  $\pm 1199$ . BIT Parameters are displayed as a single digit, 0 - 1.  
Unauthorized adjustment is prevented by means of a SECURITY CODE which must be correctly entered in PARAMETER 0 before access is permitted.  
To STORE parameter values, set PARAMETER 0 to 1 and press the RESET key.

Drive ready  
Alarm  
Zero speed  
Run forward  
Run reverse  
Bridge 1  
Bridge 2  
At speed  
Current limit

PARAMETER DATA

PARAMETER INDEX

CONTROL TECHNIQUES  
WORLDWIDE

MODE

RESET

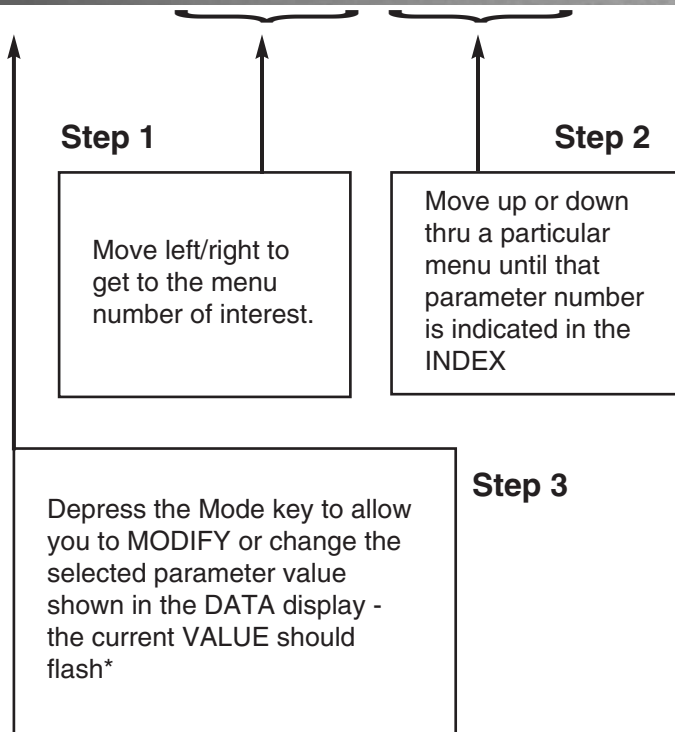
Used to move left/right to get to the menu number of interest.

Used to move up or down thru the selected menu

Parameter Menu Number MM.nn  
Example: 03.01 is % Set Speed x10  
Menu 3 Parameter Number 1

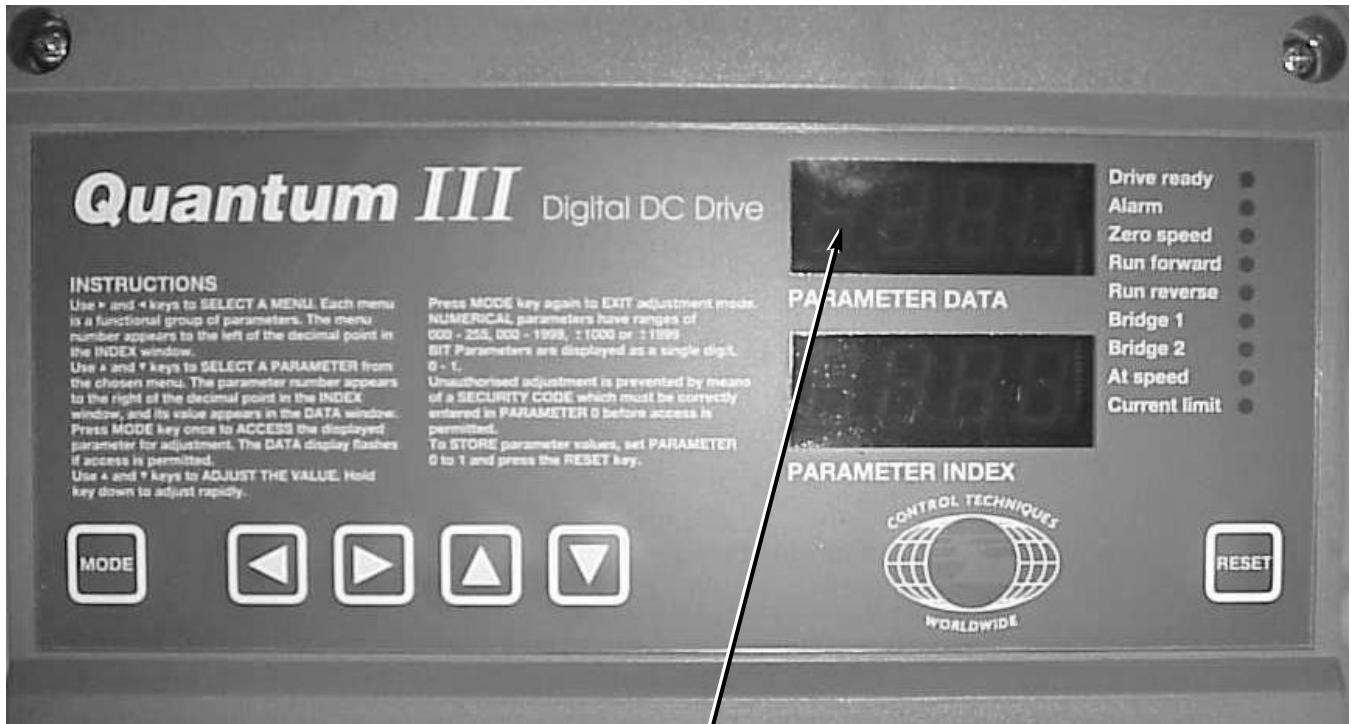
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## 8.5.7 Changing a Parameter Value



\* If DATA display does not flash either the parameter you are trying to change is secured by a security password or is for display only. See 10.3 Drive Parameters.

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### Step 4

Use the arrow keys to increase or decrease to the desired value.  
**Note:** In general, adjustments take effect immediately.

### Step 5

If done changing that parameter, depress the MODE key to leave the MODIFY mode. The DATA display should now stop flashing.

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## 10.6 MENU INDEX

The menu index lists the 16 different menus available and a description of the function of the parameters associated with each menu. For detailed description of parameters, refer to paragraph 10.7.

### 10.6.1 Menu List

MENU	DESCRIPTION
00	User Menu—to give fast access to the most-used parameters
01	Speed Reference—selection of source and limits
02	Acceleration and Deceleration Ramps
03	Speed Feedback Selection and Speed Loop
04	Current — selection and limits
05	Current Loop
06	Field Control
07	Analog Inputs and Outputs
08	Logic Inputs
09	Status Outputs
10	Status Logic & Fault Information
11	Miscellaneous
12	Programmable Thresholds
13	Digital Lock
14	MD21 System Set-up
15	Applications Menu 1
16	Applications Menu 2

### 10.6.2 Parameters—Names, Range & Default Values

References in brackets (xx.xx) in the Default column indicate parameters which default to other parameters.

Parameters shown in **bold type** are those which are freely accessible only immediately after power-on.

#### NOTE

Parameters shown with an asterisk (\*) and highlighted in gray must be reset to the default shown if **factory defaults** are enacted. Refer to paragraph 10.4.2.

Parameters at the end of each menu list in italic type are invisible. Refer to paragraphs 10.4 and 10.5.

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## MENU 00 USER LIBRARY — REFER TO MENU 11

Contains ten parameters (00.01 to 00.10). The user sets parameters 11.01 to 11.10 to any parameter numbers most often required or used. These can then be accessed directly through the corresponding numbers 00.01 to 00.10, avoiding the need to call up different menus. The parameters in this menu are accessible and are not protected by Level 1 or Level 2 security.

## Menu 01 Speed Reference — Selection of source and limits

## QUANTUM III SETTINGS

ACCESSED AT	PARAMETER DESCRIPTION	PARAMETER NUMBER
0.01	Armature Voltage	3.04
0.02	Armature Current	5.02
0.03	Motor RPM	3.03
0.04	Speed Reference	1.02
0.05	AC Line Voltage	7.06
0.06	Max Speed	1.06
0.07	Jog Speed	1.05
0.08	Forward Acceleration	2.04
0.09	Forward Deceleration	2.05
0.10	Current Limit	4.05

Number	Description	Range	Type	Default	Security	Comment
01.01	Pre-offset speed reference	±1000	RO		None	
01.02	Post-offset speed reference	±1000	RO		None	
01.03	Pre-ramp reference	±1000	RO		None	
01.04	Offset	±1000	R/W	+ 000	Level 1	
<b>01.05</b>	Inch reference	±1000	R/W	+ 050	None	
<b>01.06</b>	Maximum reference forward	0 to +1000	R/W	+1000	None	
01.07	Minimum reference forward	0 to +1000	R/W	+000	Level 1	
01.08	Minimum reference reverse	-1000 to 0	R/W	+000	Level 1	
<b>01.09</b>	Maximum reference reverse	(4Q)-1000 to 0	R/W	-1000	None	
		(1Q)-1000 to 0	R/W	000	None	
01.10	Bipolar reference selector	(4Q) 0 or 1	R/W	1	Level 1	
		(1Q)0 or 1	R/W	0	Level 1	
<b>01.11</b>	Reference 'ON'	0 or 1	R/W	0	None	
<b>01.12</b>	REVERSE selector	0 or 1	R/W	0	None	
<b>01.13</b>	INCH selector	0 or 1	R/W	0	None	
01.14	Reference select 1	0 or 1	R/W	0	Level 2	
01.15	Reference select 2	0 or 1	R/W	0	Level 2	
01.16	Zero reference interlock	0 or 1	R/W	0	Level 2	
01.17	Reference 1	±1000	R/W	(07.15)	Level 2	TB1-03
01.18	Reference 2	±1000	R/W	+300	Level 2	
01.19	Reference 3	±1000	R/W	(07.13)	Level 2	TB1-06
01.20	Reference 4	±1000	R/W	(07.14)	Level 2	TB1-07

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## MENU 02 ACCELERATION AND DECELERATION RAMPS

Number	Description	Range	Type	Default	Security	Comment
02.01	Post-ramp reference	$\pm 1000$	RO		None	
02.02	Ramp enable	0 or 1	R/W	1	Level 1	
02.03	Ramp hold	0 or 1	R/W	0	Level 1	
<b>02.04</b>	Forward acceleration 1	0 to 1999	R/W	+ 050	None	Accel
<b>02.05</b>	Forward deceleration 1	0 to 1999	R/W	+ 050	None	Decel
<b>02.06</b>	Reverse deceleration 1	(4Q)0 to 1999	R/W	+ 050	None	
		(1Q)0 to 1999	R/W	000	None	
<b>02.07</b>	Reverse acceleration 1	(4Q)0 to 1999	R/W	+ 050	None	
		(1Q)0 to 1999	R/W	000	None	
02.08	Forward acceleration 2	0 to 1999	R/W	+100	Level 2	
02.09	Forward deceleration 2	0 to 1999	R/W	+100	Level 2	
02.10	Reverse deceleration 2	(4Q)0 to 1999	R/W	+100	Level 2	
		(1Q)0 to 1999	R/W	000	Level 2	
02.11	Reverse acceleration 2	(4Q)0 to 1999	R/W	+100	Level 2	
		(1Q)0 to 1999	R/W	000	Level 2	
02.12	Inch ramp rate	0 to 1999	R/W	+100	Level 2	Jog Acc/Dec
* 02.13	Enable inch ramp	0 or 1	R/W	1	Level 2	
02.14	Forward acceleration selector	0 or 1	R/W	0	Level 2	
02.15	Forward deceleration selector	0 or 1	R/W	0	Level 2	
02.16	Reverse deceleration selector	0 or 1	R/W	0	Level 2	
02.17	Reverse acceleration selector	0 or 1	R/W	0	Level 2	
02.18	Common ramp selector	0 or 1	R/W	0	Level 2	
02.19	RESERVED	0 or 1	R/W	0	Level 2	
* Refer to paragraph 10.4.2.						

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## MENU 03 SPEED FEEDBACK SELECTION AND SPEED LOOP

Number	Description	Range	Type	Default	Security	Comment
03.01	Final speed demand	±1000	RO		None	
03.02	Speed feedback	±1000	RO		None	
03.03	Speed readout	±1999	RO		None	Scaled by 3.16
03.04	Armature voltage	±1000	RO		None	
03.05	IR compensation output	±1000	RO		None	
03.06	Speed error	±1000	RO		None	
03.07	Speed loop output	±1000	RO		None	
03.08	Speed error integral	±1000	RO		None	
<b>03.09</b>	Speed loop P gain	0 to 255	R/W	080	None	
<b>03.10</b>	Speed loop I gain	0 to 255	R/W	040	None	
<b>03.11</b>	Speed loop D gain	0 to 255	R/W	0	None	
03.12	Digital feedback selector	0 or 1	R/W	0	Level 1	
* 03.13	AV analog feedback selector	0 or 1	R/W	1	Level 1	
<b>03.14</b>	Feedback encoder scaling	0 to 1999	R/W	+ 419	None	
* <b>03.15</b>	Maximum armature voltage	0 to 1000	R/W	+ 500	None	
<b>03.16</b>	Speed readout scaler	0 to 1999	R/W	+1750	None	
<b>03.17</b>	IR compensation	0 to 255	R/W	000	None	
03.18	<i>Hard speed reference</i>	±1000	R/W	(07.11)	Level 2	
03.19	<i>Hard speed reference selector</i>	0 or 1	R/W	0	Level 2	
03.20	<i>IR droop selector</i>	0 or 1	R/W	0	Level 2	
03.21	<i>Ramp output selector</i>	0 or 1	R/W	1	Level 2	
03.22	<i>Speed offset fine</i>	0 to 255	R/W	128	Level 2	
03.23	<i>Zero speed threshold</i>	0 to 255	R/W	16	Level 2	
03.24	<i>D-term source</i>	1 to 3	R/W	1	Level 2	
03.25	<i>Speed error filter</i>	0 to 255	R/W	128	Level 2	
03.26	<i>Tachometer input</i>	±1000	RO		None	
03.27	<i>Speed feedback range</i>	0 or 1	RO	0	None	
03.28	<i>Speed Loop Prop Gain Multiplier</i>	0 or 1	R/W	0	None	1 = #3.09 x 4
03.29	<i>Reduce PI Gains by 8</i>	0 or 1	R/W	0	None	

\* Refer to paragraph 10.4.2.



# 10 Keypad, Displays, & Drive Parameters

## MENU 04 CURRENT — SELECTION AND LIMITS

Number	Description	Range	Type	Default	Security	Comment
04.01	Current demand	±1000	RO		None	
04.02	Final current demand	±1000	RO		None	
04.03	Over-riding current limit	±1000	RO		None	
04.04	I limit (taper start point)	0 to 1000	R/W	+1000	Level 1	
<b>04.05</b>	I limit Bridge 1	0 to 1000	R/W	+1000	None	
<b>04.06</b>	I limit Bridge 2	0 to 1000	R/W	+1000	None	
04.07	I limit 2	0 to 1000	R/W	+1000	Level 2	
04.08	Torque reference	±1000	R/W	+000	Level 2	
04.09	Current offset	±1000	R/W	+000	Level 2	
04.10	I limit 2 selector	0 or 1	R/W	0	Level 2	
04.11	Current offset selector	0 or 1	R/W	0	Level 2	
04.12	Mode bit 0	0 or 1	R/W	0	Level 2	
04.13	Mode bit 1	0 or 1	R/W	0	Level 2	
04.14	Quadrant 1 enable	0 or 1	R/W	1	Level 2	
04.15	Quadrant 2 enable	Regen (4Q) 0 or 1	R/W	1	Level 2	
		Non Regen (1Q) 0 or 1	R/W	0	Level 2	
04.16	Quadrant 3 enable	Regen (4Q) 0 or 1	R/W	1	Level 2	
		Non Regen (1Q) 0 or 1	R/W	0	Level 2	
04.17	Quadrant 4 enable	Regen (4Q) 0 or 1	R/W	1	Level 2	
		Non Regen (1Q) 0 or 1	R/W	0	Level 2	
04.18	Enable Auto-I-limit-change	0 or 1	R/W	0	Level 2	
04.19	Current limit timer	0 to 255	R/W	000	Level 2	
04.20	Current taper 1 threshold	0 to 1000	R/W	+1000	Level 2	
04.21	Current taper 2 threshold	0 to 1000	R/W	+1000	Level 2	
04.22	Current taper 1 slope	0 to 255	R/W	000	Level 2	
04.23	Current taper 2 slope	0 to 255	R/W	000	Level 2	
04.24	Taper 1 threshold exceeded	0 or 1	RO		None	
04.25	Taper 2 threshold exceeded	0 or 1	RO		None	

# 10 Keypad, Displays, & Drive Parameters

## MENU 05 CURRENT LOOP

Number	Description	Range	Type	Default	Security	Comment
05.01	Current feedback	±1000	RO		None	
05.02	Current feedback (amps)	±1999	RO		None	
05.03	Firing angle	277 to 1023	RO		None	
05.04	Slew rate limit	0 to 255	R/W	040	Level 1	
<b>05.05</b>	Current readout scaler	0 to 1999	R/W	(rating)	None	
05.06	Overload threshold	0 to 1000	R/W	+ 700	Level 1	
05.07	Overload time (heating)	0 to 255	R/W	030	Level 1	
05.08	Overload time (cooling)	0 to 255	R/W	050	Level 1	
05.09	Enable start-up auto-tune	0 or 1	R/W	0	Level 1	
05.10	<i>Reduced endstop</i>	0 or 1	R/W	0	Level 2	
05.11	<i>Overload integrator</i>	0 to 1999	RO		None	
† 05.12	<i>Discontinuous I gain</i>	0 to 255	R/W	16	Level 2	
† 05.13	<i>Continuous P gain</i>	0 to 255	R/W	16	Level 2	
† 05.14	<i>Continuous I gain</i>	0 to 255	R/W	16	Level 2	
† 05.15	<i>Motor constant</i>	0 to 255	R/W	25	Level 2	
05.16	<i>Reserved</i>	0 to 255	R/W	0	Level 2	
05.17	<i>Inhibit firing</i>	0 or 1	R/W	0	Level 2	
05.18	<i>Standstill enable</i>	0 or 1	R/W	1	Level 2	
* 05.19	<i>Standstill mode</i>	0 or 1	R/W	1	Level 2	
05.20	<i>Direct firing-angle control</i>	0 or 1	R/W	0	Level 2	
05.21	<i>Bridge lockout enable (4q12p)</i>	0 or 1	R/W	0	Level 2	
05.22	<i>Disable adaptive control</i>	0 or 1	R/W	0	Level 2	
05.23	<i>Enable (1q 12p)</i>	0 or 1	R/W	0	Level 2	
05.24	<i>Series 12P operation</i>	0 or 1	R/W	0	Level 2	
05.25	<i>Parallel 12P operation</i>	0 or 1	R/W	0	Level 2	
05.26	<i>Extra-safe bridge lockout</i>	0 or 1	R/W	0	Level 2	
05.27	<i>Continuous autotune</i>	0 or 1	R/W	0	Level 1	
05.28	<i>Reduce hysteresis on bridge changeover</i>	0 or 1	R/W	0	Level 1	
05.29	Burden resistor change bit	0 or 1	R/W	0	Level 1	
* Refer to paragraph 10.4.2.						
† Adjusted during auto tune.						

# 10 Keypad, Displays, & Drive Parameters

## MENU 06 FIELD CONTROL

Number	Description	Range	Type	Default	Security	Comment
06.01	Back-emf	0 to 1000	RO		None	
06.02	Field-current demand	0 to 1000	RO		None	
06.03	Field-current feedback	0 to 1000	RO		None	
06.04	Firing angle	261 to 1000	RO		None	
06.05	IR compensation 2 output	±1000	RO		None	
<b>06.06</b>	IR compensation 2	0 to 255	R/W	000	None	
* <b>06.07</b>	Back emf set point	0 to 1000	R/W	+1000	None	
<b>06.08</b>	Maximum field current	0 to 1000	R/W	+1000	None	Full field
06.09	Maximum field current1	0 to 1000	R/W	+500	None	Field economy
<b>06.10</b>	Minimum field current	0 to 1000	R/W	+500	None	w/ field weakening
06.11	Field feedback scaling1	0 to 255	R/W	204	Level 1	
06.12	Field economy time-out	0 to 255	R/W	030	Level 1	
06.13	Enable field control	0 or 1	R/W	0	Level 1	Enables field
06.14	Maximum field 2 selector	0 or 1	R/W	0	Level 1	
* 06.15	Enable field economy time-out	0 or 1	R/W	1	Level 1	
06.16	Field current loop gain selector	0 or 1	R/W	1	Level 1	
06.17	Voltage loop integral gain	0 or 1	R/W	0	Level 1	
06.18	<i>Enable speed gain adjustment</i>	0 or 1	R/W	0	Level 2	
06.19	<i>Direct firing angle control</i>	0 or 1	R/W	0	Level 2	
06.20	<i>Select alternative IR Comp. 1</i>	0 or 1	R/W	0	Level 2	
* 06.21	<i>Firing angle front endstop</i>	0 to 1000	R/W	+815	Level 2	
06.22	<i>Full or half control</i>	0 or 1	R/W	0	Level 2	
	(FXM5 field control only)					
06.23	<i>Reduce gain by 2</i>	0 or 1	R/W	0	Level 1	
06.24	Reduce gain by 4	0 or 1	R/W	0	Level 1	

\* Refer to paragraph 10.4.2.

*1 Range values dependent on MDA-3 revision number*

### NOTE

This menu is for size 1 Quantums 9500-8X02 thru 9500-8X06 or for Quantums that use the FXM5 Field Controller with ribbon control cable.

# 10 Keypad, Displays, & Drive Parameters

## MENU 07 ANALOG INPUTS AND OUTPUTS

Number	Description	Range	Type	Default	Security	Comment
07.01	General-purpose input 1	±1000	RO		None	TB1-04
07.02	General-purpose input 2	±1000	RO		None	TB1-05
07.03	General-purpose input 3	±1000	RO		None	TB1-06
07.04	General-purpose input 4	±1000	RO		None	TB1-07
07.05	Speed reference input	±1000	RO		None	TB1-03
07.06	RMS input voltage	0 to 1000	RO		None	AC line
07.07	Heatsink temperature	0 to 1000	RO		None	Celsius
07.08	DAC 1 source	0 to 1999	R/W	+ 201	Level 1	Ramped ref.
07.09	DAC 2 source	0 to 1999	R/W	+ 302	Level 1	Spd F/B
07.10	DAC 3 source	0 to 1999	R/W	+ 304	Level 1	Arm V
@ 07.11	<i>GP1 destination</i>	0 to 1999	R/W	+318	Level 2	Hard ref.
@ * 07.12	<i>GP2 destination</i>	0 to 1999	R/W	+408	Level 2	Torq ref.
@ * 07.13	<i>GP3 destination</i>	0 to 1999	R/W	119	Level 2	Ref. 3
@ 07.14	<i>GP4 destination</i>	0 to 1999	R/W	+120	Level 2	Ref. 4
07.15	<i>Speed destination</i>	0 to 1999	R/W	+117	Level 2	Ref. 1
07.16	<i>GP1 scaling</i>	0 to 1999	R/W	+1000	Level 2	x1.000
07.17	<i>GP2 scaling</i>	0 to 1999	R/W	+1000	Level 2	x1.000
07.18	<i>GP3 scaling</i>	0 to 1999	R/W	+1000	Level 2	x1.000
07.19	<i>GP4 scaling</i>	0 to 1999	R/W	+1000	Level 2	x1.000
07.20	<i>Speed reference scaling</i>	0 to 1999	R/W	+1000	Level 2	x1.000
07.21	<i>DAC1 scaling</i>	0 to 1999	R/W	+1000	Level 2	x1.000
07.22	<i>DAC2 scaling</i>	0 to 1999	R/W	+1000	Level 2	x1.000
07.23	<i>DAC3 scaling</i>	0 to 1999	R/W	+1000	Level 2	x1.000
07.24	<i>Reference-encoder scaling</i>	0 to 1999	R/W	+419	Level 2	
07.25	<i>Encoder reference selector</i>	0 or 1	R/W	0	Level 2	
07.26	<i>Current input selector</i>	0 or 1	R/W	0	Level 2	
07.27	<i>Current sense inverter</i>	0 or 1	R/W	0	Level 2	
07.28	<i>4mA offset selector</i>	0 or 1	R/W	1	Level 2	
07.29	<i>Invert sign GP3, GP4</i>	0 or 1	R/W	0	Level 1	
@ See appendix D * Refer to paragraph 10.4.2.						

# 10 Keypad, Displays, & Drive Parameters

## MENU 08 PROGRAMMABLE LOGIC INPUTS

Number	Description	Range	Type	Default	Security	Comment
08.01	F1 input — run permit	0 or 1	RO		None	In use by Quantum
08.02	F2 input — inch reverse	0 or 1	RO		None	
08.03	F3 input — inch forward	0 or 1	RO		None	
08.04	F4 input — run reverse	0 or 1	RO		None	
08.05	F5 input — run forward	0 or 1	RO		None	
08.06	F6 input	0 or 1	RO		None	
08.07	F7 input	0 or 1	RO		None	Free for Customer use
08.08	F8 input	0 or 1	RO		None	
08.09	F9 input	0 or 1	RO		None	
08.10	F10 input	0 or 1	RO		None	
08.11	Enable input	0 or 1	RO		None	In use
* 08.12	F2 destination	0 to 1999	R/W	+111	Level 2	Run
* 08.13	F3 destination	0 to 1999	R/W	+113	Level 2	Jog
* 08.14	F4 destination	0 to 1999	R/W	+112	Level 2	Fwd/Rev
* 08.15	F5 destination	0 to 1999	R/W	+115	Level 2	Spd 1/Spd 3
* 08.16	F6 destination	0 to 1999	R/W	+1034	Level 2	Ext. trip
08.17	F7 destination	0 to 1999	R/W	+000	Level 2	Free for Customer use
08.18	F8 destination	0 to 1999	R/W	+000	Level 2	
08.19	F9 destination	0 to 1999	R/W	+000	Level 2	
08.20	F10 destination	0 to 1999	R/W	+000	Level 2	
* 08.21	Disable normal logic functions	0 or 1	R/W	1	Level 2	In use
08.22	Invert F2 input	0 or 1	R/W	0	Level 2	
08.23	Invert F3 input	0 or 1	R/W	0	Level 2	
08.24	Invert F4 input	0 or 1	R/W	0	Level 2	
08.25	Invert F5 input	0 or 1	R/W	0	Level 2	
08.26	Invert F6 input	0 or 1	R/W	0	Level 2	
08.27	Invert F7 input	0 or 1	R/W	0	Level 2	
08.28	Invert F8 input	0 or 1	R/W	0	Level 2	
08.29	Invert F9 input	0 or 1	R/W	0	Level 2	
08.30	Invert F10 input	0 or 1	R/W	0	Level 2	
08.31	Enable inch reverse	0 or 1	R/W	0	Level 2	
08.32	Enable inch forward	0 or 1	R/W	0	Level 2	
08.33	Enable run reverse	0 or 1	R/W	0	Level 2	
08.34	Enable run forward	0 or 1	R/W	0	Level 2	

\* Refer to paragraph 10.4.2.

# 10 Keypad, Displays, & Drive Parameters

## MENU 09 STATUS OUTPUTS - OPEN COLLECTOR AND RELAY OUTPUT

Number	Description	Range	Type	Default	Security	Comment
09.01	Status 1 output	0 or 1	RO		None	
09.02	Status 2 output	0 or 1	RO		None	
09.03	Status 3 output	0 or 1	RO		None	
09.04	Status 4 output	0 or 1	RO		None	
09.05	Status 5 output	0 or 1	RO		None	
09.06	Status 6 output (relay)	0 or 1	RO		None	
09.07	Status 1 source 1	0 to 1999	R/W	+111	Level 2	
09.08	Invert status 1 source 1	0 or 1	R/W	0	Level 2	
09.09	Status 1 source 2	0 to 1999	R/W	000	Level 2	
09.10	Invert status 1 source 2	0 or 1	R/W	0	Level 2	
09.11	Invert status 1 output	0 or 1	R/W	0	Level 2	
09.12	Status 1 delay	0 to 255 sec	R/W	0	Level 2	
09.13	Status 2 source 1	0 to 1999	R/W	+1007	Level 2	At Speed
09.14	Invert status 2 source 2	0 or 1	R/W	0	Level 2	
09.15	Status 2 source 2	0 to 1999	R/W	000	Level 2	
09.16	Invert status 2 source 2	0 or 1	R/W	0	Level 2	
09.17	Invert status 2 output	0 or 1	R/W	0	Level 2	
09.18	Status 2 delay	0 or 255 sec	R/W	0	Level 2	
09.19	Status 3 source	0 to 1999	R/W	+1013	Level 2	In overload
09.20	Invert status 3 output	0 or 1	R/W	0	Level 2	
09.21	Status 4 source	0 to 1999	R/W	+1003	Level 2	In current limit
09.22	Invert status 4 output	0 or 1	R/W	0	Level 2	
09.23	Status 5 source	0 to 1999	R/W	+1006	Level 2	Phased back
* 09.24	Invert status 5 output	0 or 1	R/W	1	Level 2	
09.25	Status 6 source (relay)	0 to 1999	R/W	+1009	Level 2	At zero speed
09.26	Invert status 6 output	0 or 1	R/W	0	Level 2	
* Refer to paragraph 10.4.2.						

# 10 Keypad, Displays, & Drive Parameters

## MENU 10 DRIVE STATUS, FAULT INFORMATION, FAULT MONITORS

Number	Description	Range	Type	Default	Security	Comment
10.01	Forward velocity	0 or 1	RO		None	
10.02	Reverse velocity	0 or 1	RO		None	
10.03	Current limit	0 or 1	RO		None	In current limit
10.04	Bridge 1 enabled	0 or 1	RO		None	
10.05	Bridge 2 enabled	0 or 1	RO		None	
10.06	Electrical phase-back	0 or 1	RO		None	
10.07	At speed	0 or 1	RO		None	
10.08	Overspeed	0 or 1	RO		None	
10.09	Zero speed	0 or 1	RO		None	At zero speed
10.10	Armature voltage clamp active	0 or 1	RO		None	
10.11	Phase rotation	0 or 1	RO		None	
10.12	Drive normal	0 or 1	RO		None	Drive OK
10.13	Alarm l x t	0 or 1	RO		None	In overload
10.14	Field loss	0 or 1	RO		None	
10.15	Feedback loss	0 or 1	RO		None	
10.16	Phase loss	0 or 1	RO		None	
10.17	Instantaneous trip	0 or 1	RO		None	
10.18	Sustained overload	0 or 1	RO		None	
10.19	Processor 1 watchdog	0 or 1	RO		None	
10.20	Processor 2 watchdog	0 or 1	RO		None	
10.21	Motor overtemperature	0 or 1	RO		None	
10.22	Heatsink overtemperature	0 or 1	RO		None	
10.23	Speed loop saturated	0 or 1	RO		None	
10.24	Zero current limit	0 or 1	RO		None	
10.25	Last trip	0 to 255	RO		None	Fault history
10.26	The trip before last trip (10.25)	0 to 255	RO		None	
10.27	The trip before 10.26	0 to 255	RO		None	
10.28	The trip before 10.27	0 to 255	RO		None	
10.29	<i>Disable field loss</i>	0 or 1	R/W	0	Level 2	
10.30	<i>Disable feedback loss</i>	0 or 1	R/W	0	Level 2	
10.31	<i>Disable phase loss</i>	0 or 1	R/W	0	Level 2	
10.32	<i>Disable motor overtemperature trip</i>	0 or 1	R/W	1	Level 2	



# 10 Keypad, Displays, & Drive Parameters

## MENU 10 DRIVE STATUS, FAULT INFORMATION, FAULT MONITORS (CONT.)

Number	Description	Range	Type	Default	Security	Comment
10.33	Disable heatsink overtemperature trip	0 or 1	R/W	0 1 (For 9500-8X02,8X03)	Level 2	
10.34	External trip	0 or 1	R/W	0	Level 2	
10.35	Processor 2 trip	0 to 255	R/W	0	Level 2	
10.36	Disable current loop loss trip	0 or 1	R/W	0	Level 2	
10.37	Disable armature open circuit trip	0 or 1	R/W	0	Level 2	

## MENU 11 MISCELLANEOUS

Number	Description	Range	Type	Default	Security	Comment
* 11.01	Parameter 00.01	0 to 1999	R/W	Param. 3.04	None	Arm voltage
* 11.02	Parameter 00.02	0 to 1999	R/W	Param. 5.02	None	Arm amps
* 11.03	Parameter 00.03	0 to 1999	R/W	Param. 3.03	None	Speed readout
* 11.04	Parameter 00.04	0 to 1999	R/W	Param. 1.02	None	Speed reference
* 11.05	Parameter 00.05	0 to 1999	R/W	Param. 7.06	None	AC line voltage
* 11.06	Parameter 00.06	0 to 1999	R/W	Param. 1.06	None	Speed limit
* 11.07	Parameter 00.07	0 to 1999	R/W	Param. 1.05	None	Jog speed
* 11.08	Parameter 00.08	0 to 1999	R/W	Param. 2.04	None	Accel time
* 11.09	Parameter 00.09	0 to 1999	R/W	Param. 2.05	None	Decel time
* 11.10	Parameter 00.10	0 to 1999	R/W	Param. 4.05	None	Bridge 1 I-limit
11.11	Serial address	0 to 99	R/W	001	Level 1	
11.12	Baud rate	0 to 1	R/W	0	Level 1	
11.13	Serial Mode	1 to 3	R/W	001	Level 1	
11.15	Processor 1 version	0 to 255	RO		None	
11.16	Processor 2 version	0 to 255	RO		None	
11.17	Security code 3	0 to 255	R/W	149	Level 2	Default 149
11.18	Boot -up parameter	0 to 1999	R/W	+000	Level 2	
11.19	Serial programmable source	0 to 1999	R/W	+000	Level 2	
11.20	Serial scaling	0 to 1999	R/W	+1000	Level 2	x1.000
11.21	LEDs byte	0 to 255	R/W		Level 2	
11.22	Disable normal LED functions	0 or 1	R/W	0	Level 2	
11.23	Permissive for MDA6, Rev. 3	0 or 1	R/W	0	Level 2	
11.24	Enable AC line dip ride through	0 or 1	R/W	0		
* Refer to paragraph 10.4.2.						

## 10 Keypad, Displays, & Drive Parameters

### MENU 12 PROGRAMMABLE THRESHOLDS

Number	Description	Range	Type	Default	Security	Comment
12.01	Threshold 1 exceeded	0 or 1	RO		None	
12.02	Threshold 2 exceeded	0 or 1	RO		None	
12.03	Threshold 1 source	0 to 1999	R/W	+ 302	Level 1	Speed feedback
12.04	Threshold 1 level	0 to 1000	R/W	+ 000	Level 1	
12.05	Threshold 1 hysteresis	0 to 255	R/W	002	Level 1	
12.06	Invert threshold 1 output	0 or 1	R/W	0	Level 1	
12.07	Threshold 1 destination	0 to 1999	R/W	+ 000	Level 1	
12.08	Threshold 2 source	0 to 1999	R/W	+ 501	Level 1	Arm current
12.09	Threshold 2 level	0 to 1000	R/W	+ 000	Level 1	
12.10	Threshold 2 hysteresis	0 to 255	R/W	002	Level 1	
12.11	Invert threshold 2 output	0 or 1	R/W	0	Level 1	
12.12	Threshold 2 destination	0 to 1999	R/W	+ 000	Level 1	

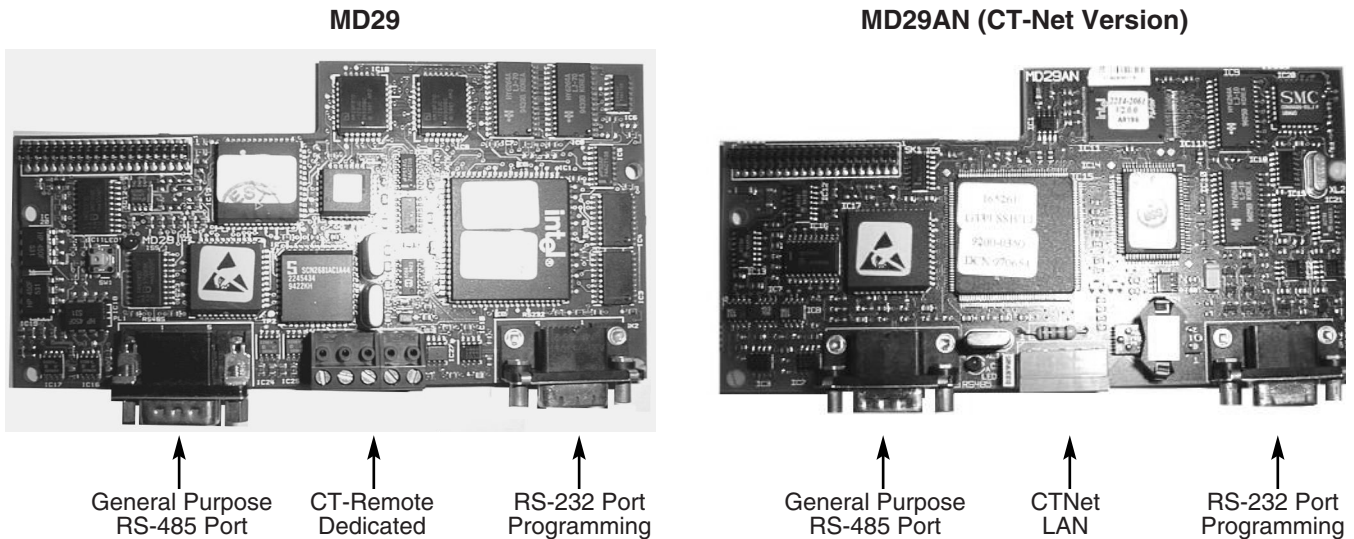
### MENU 13 DIGITAL LOCK

Number	Description	Range	Type	Default	Security	Comment
13.01	Master counter value	0 to 1023	RO		None	
13.02	Slave counter value	0 to 1023	RO		None	
13.03	Master counter increment	±1000	RO		None	
13.04	Slave counter increment	±1000	RO		None	
13.05	Position error	0 to 255	RO		None	
13.06	Precision reference, lsb	0 to 255	R/W	000	Level 1	
13.07	Precision reference, msb	0 to 255	R/W	000	Level 1	
13.08	Position loop gain	0 to 255	R/W	025	Level 1	
13.09	Position loop correction limit	0 to 1000	R/W	+ 010	Level 1	
13.10	Enable digital lock	0 or 1	R/W	0	Level 1	
13.11	Rigid lock selector	0 or 1	R/W	1	Level 1	
13.12	Precision reference selector	0 or 1	R/W	0	Level 1	
13.13	Precision reference latch	0 to 1	R/W	1	Level 1	
13.14	Precision speed reference (16 bit)	0 to 255	R/W	0	Level 1	

# 10 Keypad, Displays, & Drive Parameters

## MENU 14 OPTIONAL MD29 SET-UP PARAMETERS

Listed below are a group of parameters governing the operation of the MD-29 and MD-29AN Co-Processors. Specific details about these parameters can be found in the MD29 Manual.



Number	Description	Range	Type	Default	Security	Comment
14.01	ANSI Serial Address			1		
14.02	RS485 Mode			1		
14.03	RS485 Baud Rate			48		For modes 1, 5-9
14.04	Clock task time-base-mSec			0		
14.05	CTNet Node ID (MD29AN only)			0		
14.06	Auto-Run on Power-up Enable			1		
14.07	Global Run-time Trip Enable			1		
14.08	CT Remote I/O Trip Link Enable-RS-485			0		For CT Remote I/O Module
14.09	Enable Watchdog Trip			0		
14.10	Enable Trip on Parameter Write Overrange			1		Recommend Enable
14.11	Disable Toolkit Communications			0		For DPL Toolkit Comms
14.12	Internal Advanced Position Controller Enable			0		Not Menu 13
14.13	I/O Link Synchronization			0		For CT Remote I/O Module
14.14	Encoder Timebase Select			0		
14.16	Flash Memory Store Request			0		
14.17	Drive → Drive Communications RS232			0		

**Note:** These parameters take effect only after an MD29 or Drive Reset or thru DPL code with the REINIT command.

For additional details on these parameters, consult the MD29 Manual (Part # 0400-0027) or within the help sections of the DPL toolkit.

# 10 Keypad, Displays, & Drive Parameters

## MENU 15 OPTIONAL APPLICATIONS MENU 1

Number	Description	Range	Type	Default	Security	Comment
15.01	RO variable 1	±1999	RO		None	
15.02	RO variable 2	±1999	RO		None	
15.03	RO variable 3	±1999	RO		None	
15.04	RO variable 4	±1999	RO		None	
15.05	RO variable 5	±1999	RO		None	
15.06	Real R/W variable 1	±1999	R/W	+ 000	Level 1	
15.07	Real R/W variable 2	±1999	R/W	+ 000	Level 1	
15.08	Real R/W variable 3	±1999	R/W	+ 000	Level 1	
15.09	Real R/W variable 4	±1999	R/W	+ 000	Level 1	
15.10	Real R/W variable 5	±1999	R/W	+ 000	Level 1	
15.11	Integer R/W variable 1	0 to 255	R/W	000	Level 1	
15.12	Integer R/W variable 2	0 to 255	R/W	000	Level 1	
15.13	Integer R/W variable 3	0 to 255	R/W	000	Level 1	
15.14	Integer R/W variable 4	0 to 255	R/W	000	Level 1	
15.15	Integer R/W variable 5	0 to 255	R/W	000	Level 1	
15.16	Integer R/W variable 6	0 to 255	R/W	000	Level 1	
15.17	Integer R/W variable 7	0 to 255	R/W	000	Level 1	
15.18	Integer R/W variable 8	0 to 255	R/W	000	Level 1	
15.19	Integer R/W variable 9	0 to 255	R/W	000	Level 1	
15.20	Integer R/W variable 10	0 to 255	R/W	000	Level 1	
15.21	Bit variable 1	0 or 1	R/W	0	Level 1	
15.22	Bit variable 2	0 or 1	R/W	0	Level 1	
15.23	Bit variable 3	0 or 1	R/W	0	Level 1	
15.24	Bit variable 4	0 or 1	R/W	0	Level 1	
15.25	Bit variable 5	0 or 1	R/W	0	Level 1	
15.26	Bit variable 6	0 or 1	R/W	0	Level 1	
15.27	Bit variable 7	0 or 1	R/W	0	Level 1	
15.28	Bit variable 8	0 or 1	R/W	0	Level 1	
15.29	Bit variable 9	0 or 1	R/W	0	Level 1	
15.30	Bit variable 10	0 or 1	R/W	0	Level 1	
15.31	Bit variable 11	0 or 1	R/W	0	Level 1	
15.32	Bit variable 12	0 or 1	R/W	0	Level 1	
15.33	Bit variable 13	0 or 1	R/W	0	Level 1	
15.34	Bit variable 14	0 or 1	R/W	0	Level 1	

## 10 Keypad, Displays, & Drive Parameters

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### MENU 15 OPTIONAL APPLICATIONS MENU 1 (CONT.)

Number	Description	Range	Type	Default	Security	Comment
15.35	Bit variable 15	0 or 1	R/W	0	Level 1	
15.36	Bit variable 16	0 or 1	R/W	0	Level 1	
15.60	Ratio 1 wide integer = 15.16 & 15.17	0 to 255	R/W	000	Level 1	
15.61	Ratio 2 wide integer = 15.16 & 15.17	0 to 255	R/W	000	Level 1	
15.62	Serial mode 4 input data	RO		Level 1		
15.63	Serial mode 4 output data	RO		Level 1		

# 10 Keypad, Displays, & Drive Parameters

## MENU 16 OPTIONAL APPLICATIONS MENU 2

Number	Description	Range	Type	Default	Security	Comment
16.01	RO variable 1	±1999	RO		None	
16.02	RO variable 2	±1999	RO		None	
16.03	RO variable 3	±1999	RO		None	
16.04	RO variable 4	±1999	RO		None	
16.05	RO variable 5	±1999	RO		None	
16.06	Real R/W variable 1	±1999	R/W	+ 000	Level 1	
16.07	Real R/W variable 2	±1999	R/W	+ 000	Level 1	
16.08	Real R/W variable 3	±1999	R/W	+ 000	Level 1	
16.09	Real R/W variable 4	±1999	R/W	+ 000	Level 1	
16.10	Real R/W variable 5	±1999	R/W	+ 000	Level 1	
16.11	Integer R/W variable 1	0 to 255	R/W	000	Level 1	
16.12	Integer R/W variable 2	0 to 255	R/W	000	Level 1	
16.13	Integer R/W variable 3	0 to 255	R/W	000	Level 1	
16.14	Integer R/W variable 4	0 to 255	R/W	000	Level 1	
16.15	Integer R/W variable 5	0 to 255	R/W	000	Level 1	
16.16	Integer R/W variable 6	0 to 255	R/W	000	Level 1	
16.17	Integer R/W variable 7	0 to 255	R/W	000	Level 1	
16.18	Integer R/W variable 8	0 to 255	R/W	000	Level 1	
16.19	Integer R/W variable 9	0 to 255	R/W	000	Level 1	
16.20	Integer R/W variable 10	0 to 255	R/W	000	Level 1	
16.21	Bit variable 1	0 or 1	R/W	0	Level 1	
16.22	Bit variable 2	0 or 1	R/W	0	Level 1	
16.23	Bit variable 3	0 or 1	R/W	0	Level 1	
16.24	Bit variable 4	0 or 1	R/W	0	Level 1	
16.25	Bit variable 5	0 or 1	R/W	0	Level 1	
16.26	Bit variable 6	0 or 1	R/W	0	Level 1	
16.27	Bit variable 7	0 or 1	R/W	0	Level 1	
16.28	Bit variable 8	0 or 1	R/W	0	Level 1	
16.29	Bit variable 9	0 or 1	R/W	0	Level 1	
16.30	Bit variable 10	0 or 1	R/W	0	Level 1	
16.31	Bit variable 11	0 or 1	R/W	0	Level 1	
16.32	Bit variable 12	0 or 1	R/W	0	Level 1	
16.33	Bit variable 13	0 or 1	R/W	0	Level 1	
16.34	Bit variable 14	0 or 1	R/W	0	Level 1	
16.35	Bit variable 15	0 or 1	R/W	0	Level 1	
16.36	Bit variable 16	0 or 1	R/W	0	Level 1	

## 10.7 DESCRIPTION OF PARAMETERS

Please refer to the parameter logic diagram, Figure 10-3, and the individual menu diagrams, Figures 10-4 through 10-18.

A drive, as supplied from the factory, has a standard setting for every parameter; this is its “default” value. The system of control is shown in its default condition in Figure 10-3 before any control or configuration changes have been applied.

In the default state and without altering any parameter, the drive operates a motor under speed and torque control. Minimum essential inputs are—

- a **speed reference** (demand) at terminal TB1-3;
- a **speed feedback**—refer to parameters 03.12 and 03.13 to select type;
- a “**drive enable**” signal at terminal TB4-31;
- a “**run permit**” signal at terminal TB3-21;
- a “**drive run**” signal at terminal TB3-25.

The final output of the logic is to define the firing angle, upon which depends the output voltage to the armature. External inputs (extreme left), parameter values, and selectors contribute to the final value of the firing angle parameter.

The most significant value in normal operation is the speed reference. The figure shows that the external speed demand finally controls the firing angle, but that it may be modified several times and in different ways by other factors.

The first selectable setting enables the speed reference input signal to be configured as a bipolar signal if required (#1.10). This is followed by a selector option which controls the dynamics of the speed reference signal, and enables the operator rapidly to communicate “run”, “inch/jog”, “forward”, “reverse”, and “stop” signals.

Control of reversal of direction should follow, and after that a selector which provides a “stop” signal by imposing a “zero speed” demand. Up to this stage there are also three read-only (RO) parameters, 01.01, 01.02, and 01.03, enabling the input signal state at each point to be displayed.

At this point in the control logic, the external speed demand is compared with the chosen “actual” speed parameter to produce the speed error parameter. The source of the actual speed feedback can be selected from one of two external sources, encoder or tachometer, or from the internally-computed armature voltage parameter 03.04.

The proportional, integral, and derivative (PID) gains are then applied, followed by the four current-limiting parameters. Note that the default values of the PID parameters are values which are likely to be good for average loads, but that the default current limits are set at maximum. The rate of change of the amplified speed error is finally limited if necessary by the slew rate parameter. By this stage, the speed demand has become a current demand, and is now summed algebraically with current feedback to generate the reference that controls the SCR bridge firing angle. From the ramp to the firing angle there are four interposed RO parameters for interrogation and to assist with precise modeling of the control system.

In addition, the most significant factors of drive condition are available from status bits (refer to Menu 10, paragraph 10.7.10).

The purpose and application of the different menus and of each individual parameter is explained in Paragraphs 10.7.0 through 10.7.16.



# 10 Keypad, Displays, & Drive Parameters

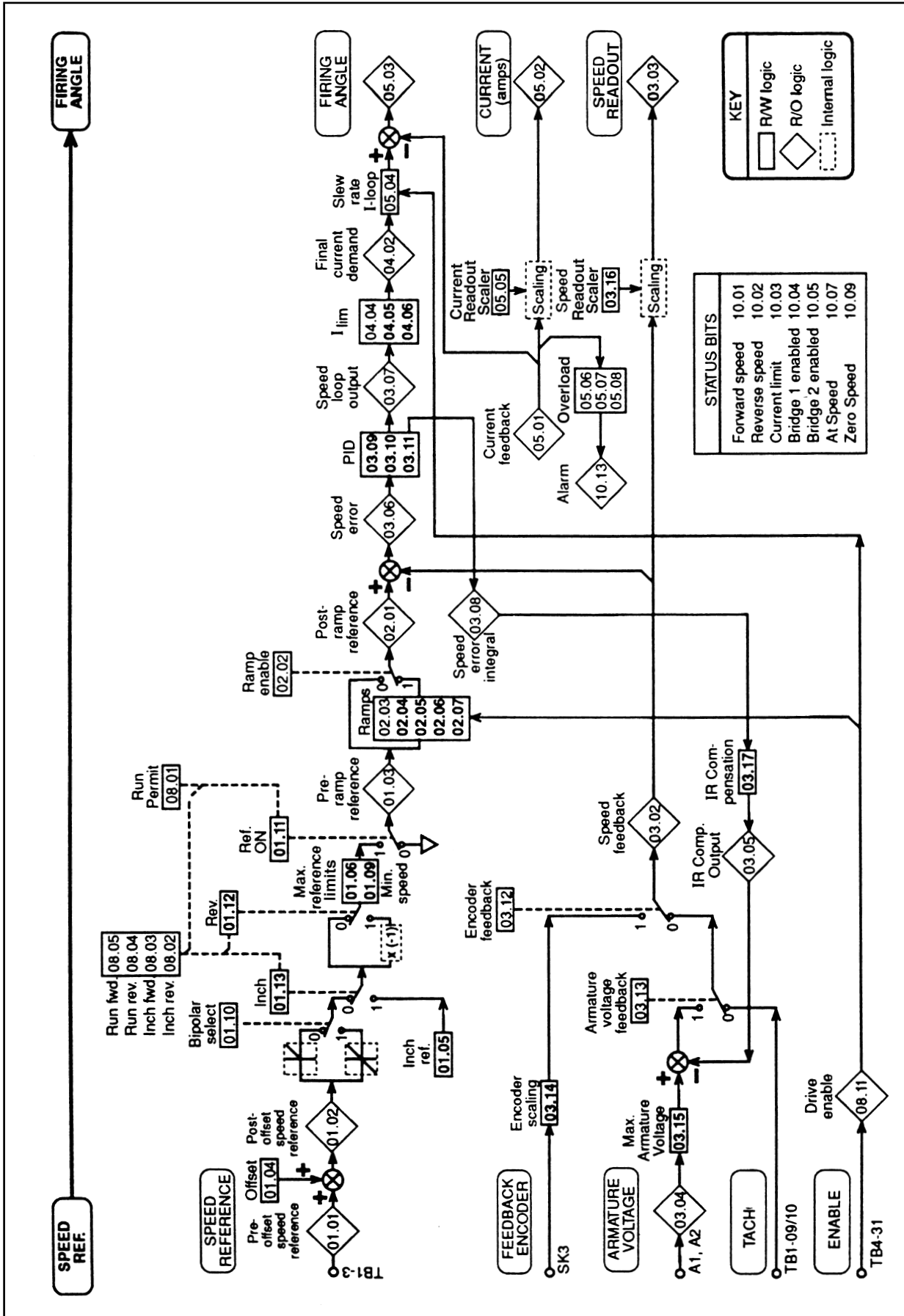


Figure 10-3.  
Parameter Logic Overview

# 10 Keypad, Displays, & Drive Parameters

## NOTE

In the following descriptions, parameters shown with an asterisk (\*) must be reset to the default shown if **factory defaults** are enacted. They are not affected when power on defaults are selected. Refer to paragraph 10.4.2.

### 10.7.0 MENU 00—User Menu

This menu allows any 10 parameters from any menu to be combined in menu 00. They can be monitored, written to, and are not protected by security. These parameters are defined in menu 11.

The following parameters have been programmed to this menu at the factory. They may be changed at any time:

ACCESSED AT	PARAMETER DESCRIPTION	PARAMETER NUMBER
0.01	Armature Voltage	3.04
0.02	Armature Current	5.02
0.03	Motor RPM	3.03
0.04	Speed Reference	1.02
0.05	AC Line Voltage	7.06
0.06	Max Speed	1.06
0.07	Jog Speed	1.05
0.08	Forward Acceleration	2.04
0.09	Forward Deceleration	2.05
0.10	Current Limit	4.05

### 10.7.1 MENU 01—Speed Reference

There are four speed reference inputs—parameters 01.17, 01.18, 01.19, and 01.20. Each of the four can be set from +1000 forward to -1000 reverse with 1000 representing full speed. Parameter 01.17 is defaulted to TB1-3 through a 12-bit D/A. This is the normal analog speed reference input. The other three inputs can be set digitally through the keypad or serial communication, or they will accept analog inputs that are scaled and converted through 10-bit D/A converters. Refer to menu 8, analog inputs. Parameters 01.14 and 01.15 control the selection of the four references as the source speed reference. The selected reference can then be modified by adding offset (01.04), selecting bipolar operation (01.10), and setting minimum and maximum limits for both forward and reverse operation (01.06 through 01.09).

Reversing for regenerative drives is achieved by switching parameter 01.12. Inch or jog speed is activated by 01.13 and set by 01.05. The speed reference at source 01.01 is the input to the zero reference interlock 01.16, which (when selected, 01.16=1) inhibits the drive starting until the speed reference is close to zero. This, in effect, simulates a speed potentiometer with a zero speed interlock.

The availability of four selective speed references offers great flexibility when interfacing with other drives or process equipment.

See Figure 10-4 for details of menu 01.

#### 01.01 RO Pre-offset speed reference

Range ±1000

Monitors the value of the speed reference continuously. Parameter 01.01 is also used to initiate the zero speed reference interlock, 01.16. This is the value applied at TB1-3--the speed reference input.

#### 01.02 RO Post-offset speed reference

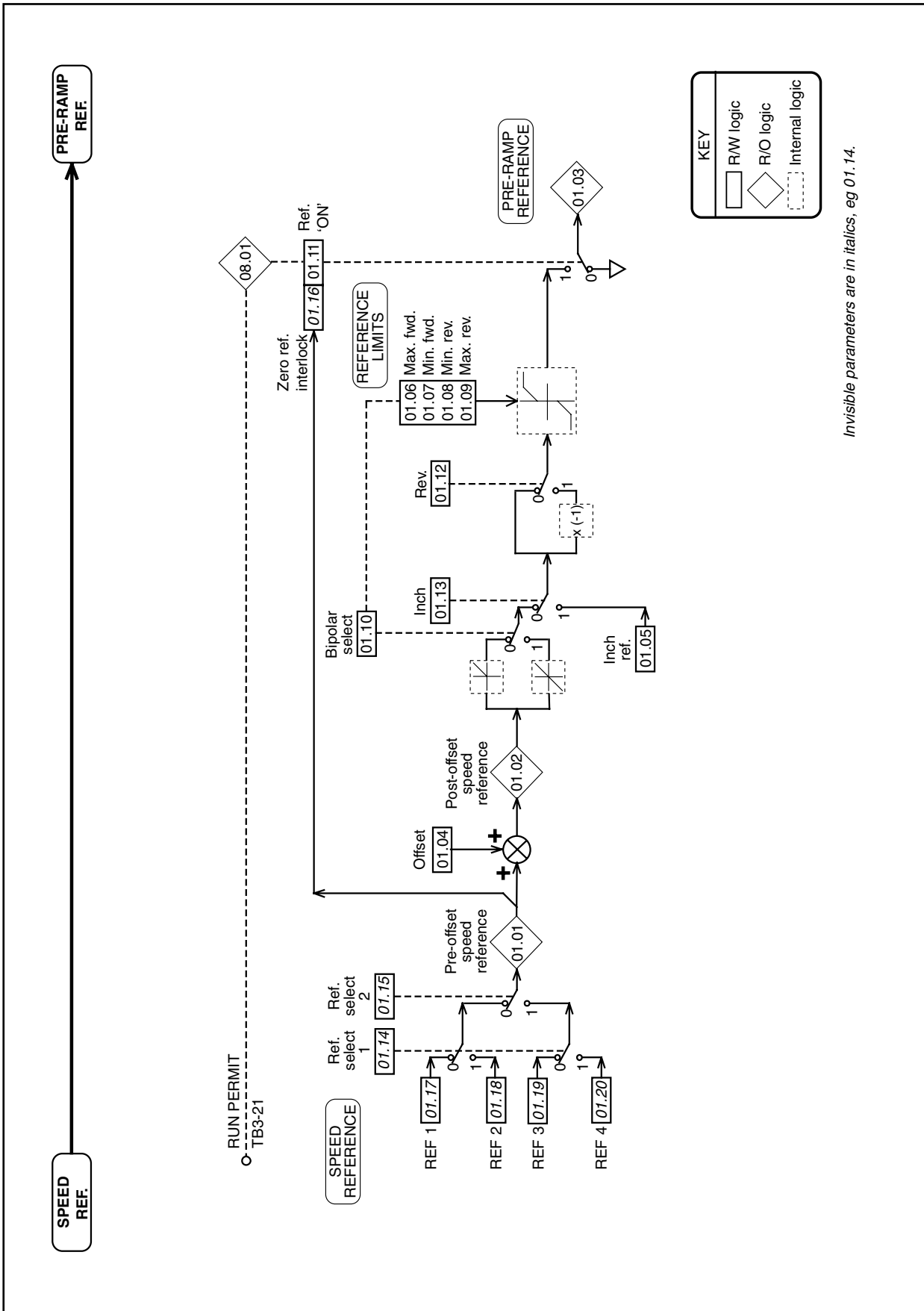
Range ±1000

Monitors the value of the speed reference after the offset, 01.04, has been added.

#### 01.03 RO Pre-ramp reference

Range ±1000

The final speed reference before any ramp rates are applied (refer to Menu 02).



*Invisible parameters are in italics, eg 01.14.*

Figure 10-4.  
Menu 01—Speed Reference Selection & Limits

# 10 Keypad, Displays, & Drive Parameters

---

## **01.04 R/W Offset**

Range ±1000

The analog reference offset is a programmable speed demand term added to the speed reference value 01.01. It is a speed trim input, for example, from a dancer arm in tension control, or can be used to set a 'creep' or minimum speed.

Default + 000

---

## **01.05 R/W Inch/Jog reference**

Range ±1000

Becomes the source of speed reference when selected by 01.13 (controlled in default by terminals TB3-22 and TB3-23). It provides the means to set a speed demand different from (and usually less than) the ordinary speed reference. Must be less than the limit set by 01.06 and 01.09. Used for internal jog speed reference.

Default + 050

---

## **01.06 R/W Max. Speed Forward Limit**

Range 0 to +1000

Sets the upper limit of speed in the forward direction of rotation.

Default +1000

---

## **01.07 R/W Min. Speed Forward**

Range 0 to +1000

Sets the lower limit of speed in the forward direction of rotation. This parameter is disabled if bipolar operation is selected (01.10=1) to prevent oscillation between the forward and reverse minimum speeds when the input speed reference is zero.

Default +000

---

## **01.08 R/W Min. Speed Reverse**

Range -1000 to 0

Sets the lower limit of speed in the reverse direction of rotation. This parameter is disabled if bipolar operation is selected (01.10=1) to prevent oscillation between the forward and reverse minimum speeds when the input speed reference is zero.

Default -000

---

## **01.09 R/W Max. Speed Reverse**

Range -1000 to 0

Sets the upper limit of speed in the reverse direction of rotation.

Default -1000 (4Q)  
000 (1Q)

---

## **01.10 R/W Bipolar selector**

In its normal state (= 1) allows the drive to respond to a bipolar analog speed reference (01.02) in which case the direction of rotation is determined by the bipolar signal. Positive polarity causes forward rotation; negative polarity, reverse. Reversal of direction is then possible by 01.12 (in a four-quadrant drive). When 01.10 = 0 the drive responds in a unipolar mode, negative-polarity signals being treated as a zero speed demand.

Default — 4Q 1, bipolar mode

Default — 1Q 0, unipolar mode

---

## **01.11 R/W Reference 'ON'**

Applies the speed reference to 01.03, pre-ramp reference. Defaults to zero if terminal TB3-21 (Run permit) is de-activated. Cannot be set to 1 unless terminal TB3-21 is activated. Is also subject to the status of the normal logic functions — refer to Menu 08. Controlled in default by terminals TB3-22, TB3-23, TB3-24, TB3-25

Default 0, no speed reference

---

## **01.12 R/W Run/Jog Reverse selector**

Reverse select inverts the polarity of the run speed reference signal and the inch/jog signal. It has the effect (in a four-quadrant drive) of reversing the sense of the speed signal without regard to the nominal direction of motor rotation. Default value 01.12 = 0, inversion not applied. Controlled in default by terminals TB3-22, TB3-23, TB3-24, and TB3-25.

Default 0, reverse not selected

---

## **01.13 R/W Inch/Jog selector**

Inch/Jog select replaces all other speed demand references with the inch/jog reference 01.05. Default value 01.13=0, normal speed reference applied. Controlled in default by terminals TB3-22, TB3-23.

Default 0, inch not selected

---

## **01.14 R/W Reference selector 1**

Selects references 1 and 3 or references 2 and 4. The two reference selectors 01.14 and 01.15 in combination enable any one of the four speed references 01.17 to 01.20 to be selected.

Default 0

---

## 10 Keypad, Displays, & Drive Parameters

---

### 01.15 R/W Reference selector 2

Selects references 1 and 2 or references 3 and 4. The two reference selectors 01.14 and 01.15 in combination enable any one of the four internal speed references 01.17 to 01.20 to be selected.

Default     0

---

### 01.16 R/W Zero reference interlock

Inhibits the starting of the drive until the analog speed reference, external or internal, is near to zero—(≈1.5% of full speed). This capability is convenient in applications where, for safety or process reasons, the operator determines speed by observations of the process—for example, extrusion, or traction drives. This function simulates a potentiometer with a zero speed interlock—except the drive will run after the pot has been returned to zero, then given a ± reference.

Default     0, inhibit not applied

Not applicable to Quantum III, see Application Notes Section at the end of this manual.

### CAUTION

**As soon as the reference becomes zero the drive will become enabled. A preferred method of accomplishing this function is described in the rear of this manual in the application note section.**

---

### 01.17 R/W Ref #1

Defaulted to TB1-3, the external speed potentiometer input, by parameter 07.15. Encoder reference can be selected by parameter 7.25=1.

---

### 01.18 R/W Ref #2

Default to internal speed reference.

Default     +300

---

### 01.19 R/W Ref #3

Defaulted to TB1-5, analog input, by parameter 07.12.

---

### 01.20 R/W Ref #4

Defaulted to TB1-6, analog input, by parameter 07.13.

---

# 10 Keypad, Displays, & Drive Parameters

## 10.7.2 MENU 02—Ramps

Refer to Figure 10-5.

The options available for setting ramps are:

1. No ramps at all, bypassing the ramp functions.
2. A selection of forward and reverse ramps for normal run conditions and an optional separate ramp for inching.

The arrangement for selecting running ramps gives the maximum flexibility. There are two possible ramp values available for each mode of operation, e.g., forward accelerations 1 and 2, forward decelerations 1 and 2, and so on. A common ramp selector enables switching between the two groups (all the 1s or all the 2s). Also, it is possible to change ramps 1 and 2 of any quadrant within the common selection. Ramp selectors may be controlled by any of the logic programmable inputs.

To activate the inch ramp, a “select” signal is required from 01.13 in addition to the “enable” function 02.13. The time of all the selected ramps can be increased by a factor of 10 by parameter 02.19.

The ramp operation can be interrupted by the ramp hold parameter, which holds the ramp output at its present value when set to 1. Ramp disable overrides this feature.

The value of the speed reference signal after the ramp is monitored by the post-ramp reference.

---

### 02.01 RO Post-ramp Reference

Range ±1000rpm

Monitors the value of the speed reference after it has bypassed or been modified by the ramps selected.

---

### 02.02 R/W Ramp Enable

Activates ramp functions. If set to disable, makes the post-ramp speed reference 02.01 equal to the pre-ramp speed reference 01.03, effectively bypassing all ramp functions.

Default 1, enabled

---

### 02.03 R/W Ramp Hold

Holds the ramp output at its present value when set to 1. By using a programmable input to control this parameter, the speed of the drive may be controlled from ‘increase’ and ‘decrease’ pushbuttons instead of a potentiometer or other continuously-variable reference source, thus simulating a “MOP” function.

Default 0

---

### 02.04 02.05 02.06 02.07 R/W

GROUP 1 Fwd. Accel & Decel., Rev. Decel & Accel

Range 0 to 1999 tenths of seconds

Defines the time taken to accelerate from zero speed to maximum speed, or to decelerate from maximum speed to zero speed as appropriate (01.03=1000). Each parameter is individually settable.

Default +050 = 5 sec

---

### 02.08 02.09 02.10 02.11 R/W

GROUP 2 Fwd. Accel & Decel., Rev. Decel & Accel

Range 0 to 1999 tenths of seconds

Defines the time taken to accelerate from zero speed to maximum speed, or to decelerate from maximum speed to zero speed as appropriate (01.03=1000). Each parameter is individually settable.

Default +100 = 10 sec

**See Appendix E**

---

### 02.12 R/W Inch/Jog Ramp Rate

Range 0 to 1999 tenths of seconds

To select, 02.13=1. Defines the rate of acceleration and deceleration when the Inch/Jog reference is selected (01.13=1).

Default +100=10 sec

---

### \*02.13 R/W Enable Inch/Jog Ramp

Selects a dedicated ramp rate (defined by 02.12) when inching or jogging. If not selected, the normal ramps 02.04 through to 02.11 are used for inching and jogging as well as running.

Default 1, enable = Quantum III factory setting  
0 (factory default)

---

### 02.14 02.15 02.16 02.17 R/W

Fwd. Accel & Decel., Rev. Decel & Accel—Select from Group 1 or 2

These selectors enable ramps to be chosen from either of the two groups at will. This permits individual acceleration and/or deceleration rates to be changed on receipt of an appropriate command.

Default 0, Ramp 1

---

### 02.18 R/W Common Ramp Select

Enables selection between all ramps of Group 1 (if 02.14 to 02.17 = 0), or all of Group 2.

Default 0, Group 1

---

### 02.19 R/W Ramp Scaling

When set to 1, all ramps are multiplied by 10.

Default 0

---

\*Refer to paragraph 10.4.2.

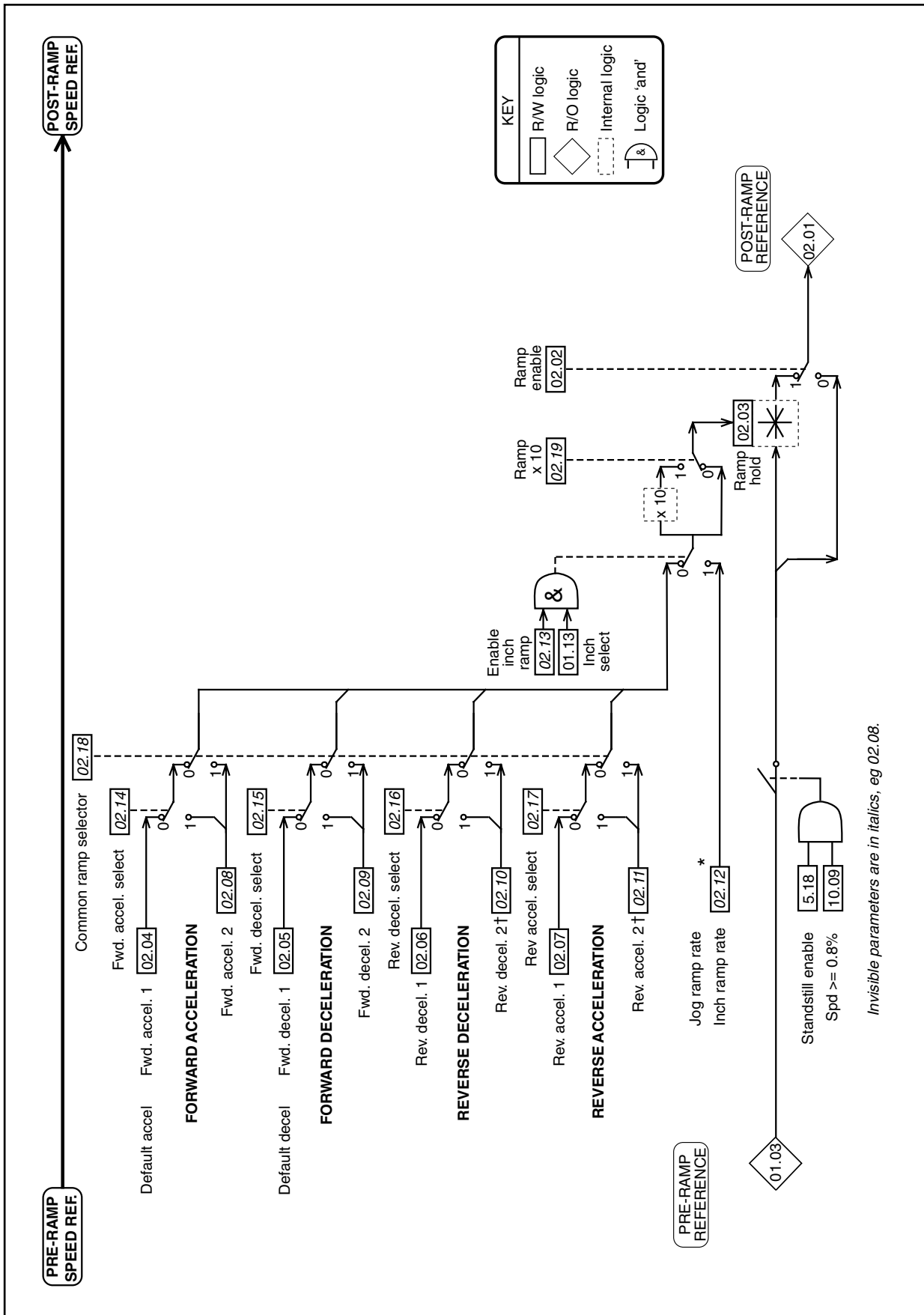


Figure 10-5.  
Menu 02—Ramp Selection

\* See appendix E



# 10 Keypad, Displays, & Drive Parameters

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## 10.7.3 MENU 03 — Feedback Selection and Speed Loop

Refer to Figure 10-6.

The primary inputs are the post-ramp reference 02.01 and the hard speed reference (03.18). Final speed demand (03.01) can be either of these inputs or a summation of both. The selected input can be modified by the addition of an offset, which may be zero. The result of this summation is the final speed demand (03.01) which is added algebraically to the speed feedback to become the speed error (03.06). The speed error is finally proportioned by the PID function to become the speed loop output (03.07).

Speed feedback is derived from one of three possible sources— encoder, tachometer, or armature voltage. Whichever source is selected becomes the speed feedback (03.02). The selection is controlled by 03.12 and 03.13. The value is used for the closed-loop speed control of the motor. Scaling of the encoder signal is set by 03.14, and of the armature voltage feedback is controlled by the setting of maximum armature voltage 03.15. A potentiometer is provided for scaling the tachometer feedback signal. The speed feedback 03.02 is summed with the final speed demand 03.01 at the speed loop summation point. If the armature voltage is selected, it is first summed with the IR compensation (03.05) which is derived from the integral function of the speed error and the IR compensation factor. It is then either added to or subtracted from the scaled armature voltage feedback according to whether IR compensation or IR droop is selected.

The armature voltage feedback is passed to a comparator to provide a voltage clamp, used internally to prevent armature overvoltage. This clamp is used only if the armature voltage has NOT been selected as the feedback. Parameter 03.15 becomes the clamp level.

The speed feedback value is used for two further purposes — to supply a speed indication in rpm, and to indicate zero speed.

---

### 03.01 RO Final Speed Demand

Range ±1000

Monitors the value of the speed reference after it has bypassed or been modified by the ramps and/or by the hard speed reference (03.18) and speed offset fine (03.22). It is the speed reference which is sent to the speed loop summation point.

---

### 03.02 RO Speed Feedback

Range ±1000

Monitors the value of the speed feedback, derived from one of the following three sources — encoder, tachometer, or armature voltage. The selection of feedback is controlled by 03.12 and 03.13.

---

### 03.03 RO Displayed Speed Feedback

Range ±1999rpm

Scaled value of motor speed feedback for external information. Requires correct setting of 03.16, maximum speed scaler.

---

### 03.04 RO Armature Voltage

Range ±1000 (direct reading in Volts)

Monitors the value of armature volts.

---

### 03.05 RO IR Compensation Output

Range ±1000

The result of selected value of IR compensation (03.17) acting on the speed loop integral output.

---

### 03.06 RO Speed Error

Range ±1000

The result of the summation of the final speed demand and the speed feedback, after filtering.

---

### 03.07 RO Speed Loop Output

Range ±1000

Speed demand forward to become current demand (menu 04).

---

### 03.08 RO Speed Error Integral

Range ±1000

The integrated value of the speed error 03.06. Used as input to the IR compensation calculation when using armature voltage feedback (AVF).

---

# 10 Keypad, Displays, & Drive Parameters

---

## 03.09 R/W Speed Loop Proportional Gain

Range 0 to 255

The factor by which the speed error is multiplied to produce the correction term.

$$\text{Factor} = \frac{\text{value of 03.09}}{8}$$

Increasing this value increases both the system damping and the transient speed response, and if made too high for a given load the system will become unstable. The optimum setting is the highest value possible before instability starts to occur. Optimum speed loop performance is achieved by judicious combination of all three gains of the PID algorithm.

Default 080

---

## 03.10 R/W Speed Loop Integral Gain

Range 0 to 255

The factor by which the speed error is multiplied to produce the correction term.

$$\text{Factor} = \frac{6f \times (03.10)}{256}$$

where  $f$  = supply frequency

This term ensures zero speed error during steady state load conditions. Increasing the value increases the rate of recovery after a disturbance. If the term is made too high, speed tends to oscillate instead of settling quickly. The optimum setting is the highest value possible before oscillation starts to occur. Optimum speed loop performance is achieved by judicious combination of all three gains of the PID algorithm.

Default 040

---

## 03.11 R/W Speed Loop Derivative Gain

Range 0 to 255

The factor by which the speed error is multiplied to produce the correction term. There are three possible sources of input to this term—either final speed demand 03.01, speed feedback 03.02, or speed error 03.06. The selector is 03.24. The derivative term is a function of the rate of change of value of the input.

If the input is the speed error 03.06, output is negative if speed error is increasing. This has a damping effect.

If the input is the final speed demand 03.01, output is positive when the final speed demand is increasing. This is called "velocity feed forward".

If the input is the speed feedback 03.02, output is negative if speed feedback is increasing. This also has a damping effect, but dependent on the changing value of the speed feedback only, not the speed reference.

Default 0

---

## 03.12 R/W Digital feedback selector

Set to 1 to select encoder feedback. Set to 0 to select analog feedback.

Default 0, analog feedback selected

---

## \*03.13 R/W Armature Voltage / External Analog Feedback Selector

Determines the type of analog speed feedback when 03.12 is set to 0. Set to 1 to select armature voltage feedback. Default setting selects analog feedback from a tachometer or equivalent external source connected to terminal TB1-09.

Default 1, AVF selected = factory setting  
0 (drive default)

---

## 03.14 R/W Encoder Feedback Scaling

Range 0 to 1999

The value should be set to correspond with the maximum speed of the motor and with the number of lines-per-revolution of the encoder. To calculate the scale factor —

$$\text{Scale factor} = \frac{750 \times 10^6}{N \times n}$$

where  $N$  = number of lines-per-revolution (encoder)

and  $n$  = max speed of motor in rpm.

The default value is determined on the basis of a 1024-line encoder, and a maximum speed of 1750rpm.

Default +419

---

## \*03.15 R/W Maximum Armature Volts

Range 0 to 1000

Defines the maximum voltage permitted to be applied to the armature. When armature voltage is the selected feedback (03.12 = 0 and 03.13 = 1), the max. armature voltage value is used for scaling the armature voltage measurement so that speed feedback is full scale at maximum voltage. An automatic scale factor of 1.2 is applied to clamp the armature voltage feedback to 20% above maximum to allow for overshoot.

If the speed feedback is derived from an encoder or tachometer, the armature voltage is continuously monitored, and a clamp is applied when the voltage exceeds that set in 03.15. This can be used to prevent the voltage rising above a set level.

Default +500 = Quantum III factory setting  
+600 (drive default)

---

\* Refer to paragraph 10.4.2.

# 10 Keypad, Displays, & Drive Parameters

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## 03.16 R/W Speed Readout Scaler

Range 0 to 1999

Used only to scale the speed feedback so that the value displayed in 03.03 is actual speed in rpm. The value applied to 03.16 should be the max. speed in rpm (divided by ten if the maximum speed is >1999rpm); speed displayed in 03.03 is then rpm / 10. This does not affect motor speed.

If desired 03.03 could be scaled to readout machine speeds. Example: At 100% motor speed machine puts out 250 bottles/min. Place 250 into #3.16.

Default + 1750

---

## 03.17 R/W IR Compensation

Range 0 to 255

$$\text{Value of 03.05} = \frac{(03.08) \times (03.17)}{2048}$$

This value is used to calculate the compensation needed for the resistive voltage-drop of the armature to improve speed control with varying loads when the selected speed feedback is the armature voltage.

IR compensation is a positive feedback, and may give rise to instability if set too high. Furthermore, modern laminated-frame motors have typically a rising load-speed characteristic unsuited to armature voltage feedback with IR compensation. IR compensation is more suited to compound-wound motors with a flat (not rising) load-speed characteristic.

The integral of the speed error is used as the input to IR compensation rather than current feedback because it has the least amount of ripple of the variables; in speed control, the value of the speed error integral is the steady-state value of current demand.

Default 000

---

## 03.18 R/W Hard Speed Reference

Range ±1000

Speed reference fed into the speed loop without passing through the ramps.

Default (07.11)

---

## 03.19 R/W Hard Speed Reference Selector

If 03.19 is set to 1, and Ref "ON" (01.11) =1, the Hard Speed reference (3.18) is added at the speed loop summation point. For hard reference only, 03.21 must = 0.

Default 0

---

## 03.20 R/W IR Droop Selector

If 03.20=1 when using armature voltage as the speed feedback, speed will decrease as load increases.

A typical application, for example, is a mechanical blanking press with a heavy flywheel. Applying IR droop prevents the drive from delivering a sudden increase of current at the moment of impact (sudden increase of torque demand). It is better that the drive deliver energy to the flywheel during the whole operating cycle rather than mostly at the moment of impact.

Default 0

---

## 03.21 R/W Ramp Output Selector

When 03.21=1, Ramp output is added at the speed loop summation point.

Default 1

---

## 03.22 R/W Speed Offset Fine

Range 0 to 255

Used as a fine trim on the speed reference signal to correct, or introduce, a small offset.

0 = maximum negative offset

256 = maximum positive offset

Default 128

---

## 03.23 R/W Zero Speed Threshold

Range 0 to 255

The threshold may be adjusted to any value up to 25.5% of maximum speed. Refer also to 10.09.

Default 16

---

## 03.24 R/W Derivative Term Source

Range 1,2, or 3

The derivative term of the PID in the speed loop may use one of three sources—

1=Speed error of 03.06

Damping changes in speed demand and feedback

2=Speed reference 03.01

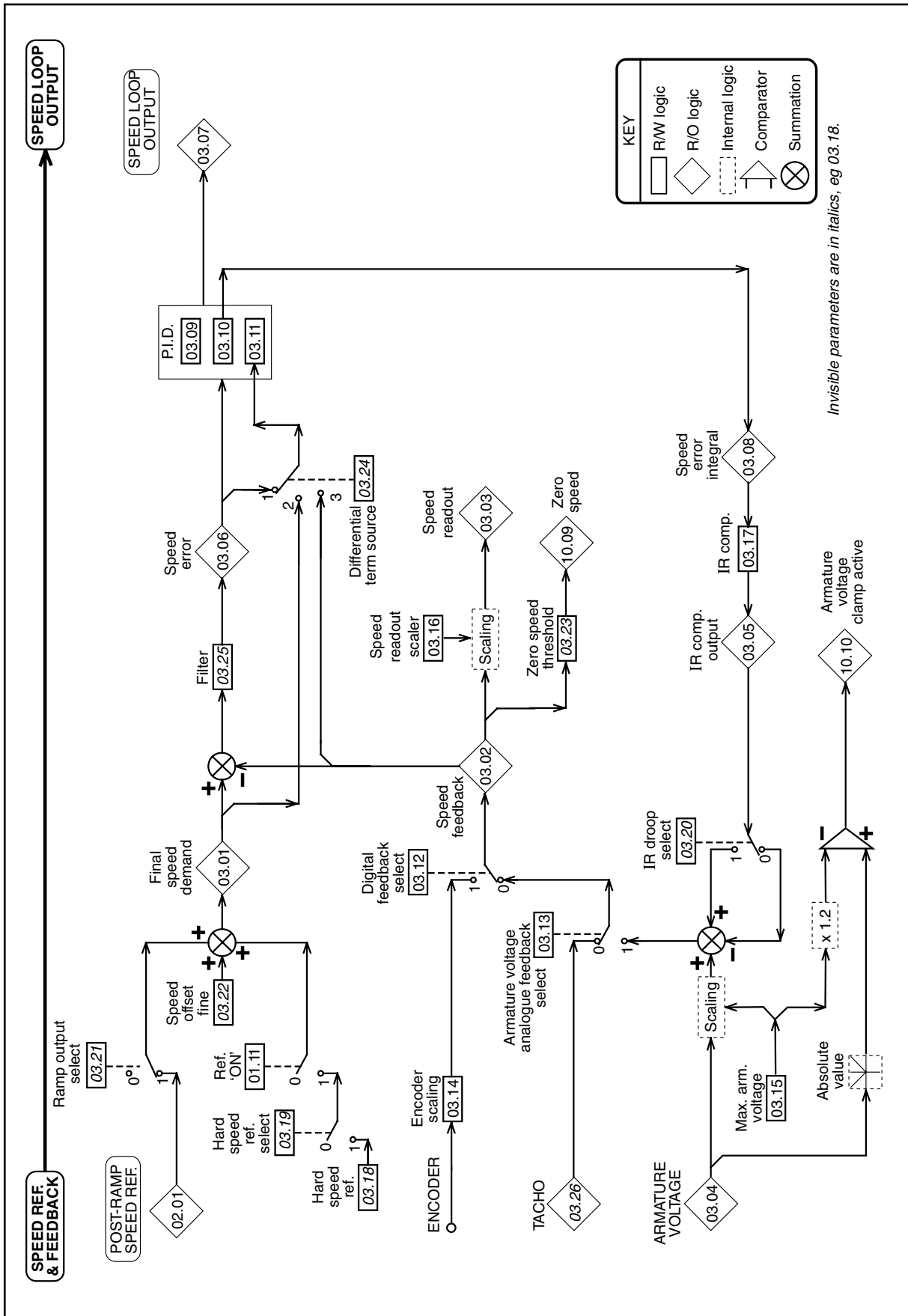
Velocity feed forward

3=Speed feedback 03.02

Damping on feedback only ("feedback forcing").

Default 1

---



**Figure 10-6.**  
Menu 03—Feedback Selection & Speed Loop

# 10 Keypad, Displays, & Drive Parameters

---

## **03.25 R/W Speed Error Filter**

Range 0 to 255

$$\text{Filter time constant} = \frac{256}{6f \times (03.25)}$$

where,  $f$  = supply frequency

A low-pass filter to reduce the effect of interference on the speed error signal (03.04) —from a noisy tachometer, for example.

Default 128

---

## **03.26 RO Tachometer Input**

Range  $\pm 1000$

Monitors the tachometer input measurement. The tachometer potentiometer scales the feedback signal such that at full motor speed, 03.26 = 1000. Units displayed = 0.1% of full speed per increment.

---

## **3.27 RO Speed Feedback Range**

03.27 = 0 03.16 set up in rpm

03.27 = 1 03.16 is (rpm+10) ie 03.16 = 600 for 600 rpm  
Similar to 05.15, this parameter indicates to the optional LCD pod the speed feedback range in which parameter 03.16 has been set up.

---

## **3.28 R/W Increase P Gain by 4**

Range 0 or 1

Setting this parameter at 1 will increase the speed loop proportional gain by a factor of 4.

Proportional Gain x 4.

Default 0

---

## **03.29 R/W Reduce P and I Gain by 8**

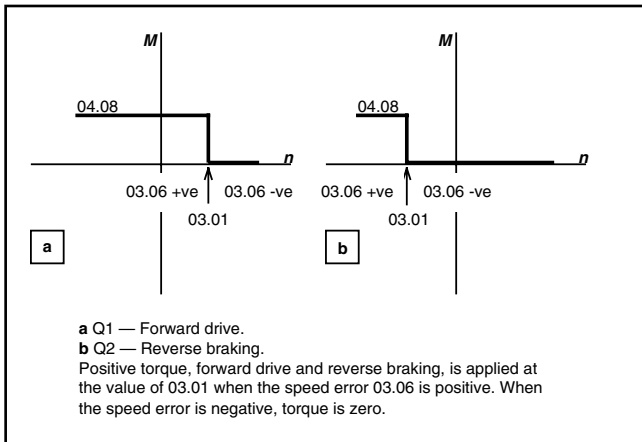
Range 0 or 1

Enables the user to increase the burden resistors by a factor of 1.6. Reduce P and I gain by 8 if set to 1.

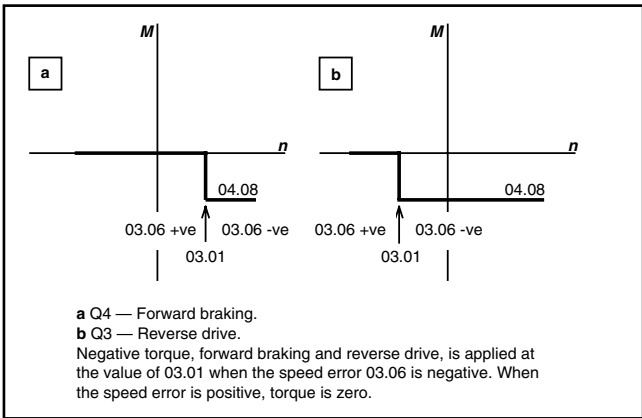
Default 0

---

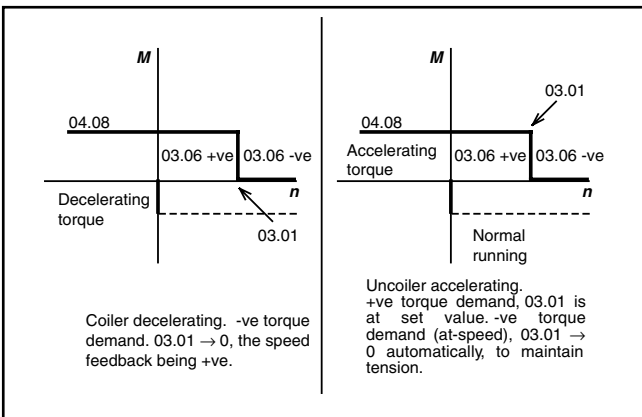
# 10 Keypad, Displays, & Drive Parameters



**Figure 10-7.**  
**Torque Control With Speed Override.**  
**Positive Torque Reference.**



**Figure 10-8.**  
**Torque Control With Speed Override.**  
**Negative Torque Reference.**



**Figure 10-9.**  
**Coiler Decelerating and Uncoiler Accelerating**

## 10.7.4 MENU 04 — Current Selection and Limits

Refer to Figure 10-10.

The main input is the speed loop output (03.07). The torque reference (04.08) can be selected for pure torque control of the motor, or it can be combined with the speed loop output by 04.12 and 04.13. These inputs become the current demand to which an offset or trim may be added (04.09). The result is then subject to an overriding limitation derived from several sources including speed. Current limit is set by 04.03 for single quadrant drives. For regenerative drives, the current limit in both bridges can be individually set by 04.05 and 04.06 and each of the four quadrants enabled or disabled by 04.14 through 04.17.

A feature in this menu is the ability to set a second current limit (04.07) automatically—refer to 04.10, 04.18 and 04.19—which enable current limit 2 to be applied after a chosen time delay. This is appropriate to applications where the initial load torque on start-up is high, but after some period becomes less. An example would be some mechanical mixing processes. Current can also be tapered as a function of speed. Refer to 04.20 through 04.25.

### 04.01 RO Current Demand

**Range** ±1000

The current demand signal is the controlling input to the current loop when the drive is being operated in speed-control mode. The signal is subject to limitation by 04.03, 04.05, and 04.06 before being passed to the current loop.

### 04.02 RO Final Current Demand

**Range** ±1000

Current demand final output, to the current loop (Menu 05) after limits have been applied.

### 04.03 RO Over-riding Current Limit

**Range** ±1000

This is the limiting value of current demand and is the result of the speed-dependent current taper calculation or I-limit 2 (if selected), whichever is less. Refer to parameters shown in Figure 10-10.



# 10 Keypad, Displays, & Drive Parameters

---

## **04.04 R/W Current-limit 1 (taper start point)**

**Range** 0 to 1000 = 150% of drive rating

This parameter provides symmetrical current-limitation for bridges 1 and 2 and is the level from which the current taper functions operate—refer to 04.20 and 04.21. I-limit 1 can be used in applications where the motor kW rating is somewhat less than that of the drive, as an alternative to changing the fixed current-burden resistors.

**Default** +1000

---

## **04.05 R/W Current-limit Bridge 1**

**Range** 0 to 1000

Determines the maximum limit of current demand when bridge 1, the 'positive' bridge, is conducting. It causes any demand for current in excess of the limit set point to be clamped.

**Default** +1000 = 150% of drive rating

---

## **04.06 R/W Current-limit Bridge 2**

**Range** 0 to 1000

Determines the maximum limit of current demand when bridge 2, the 'negative' bridge, is conducting. It causes any demand for current in excess of the limit set point to be clamped.

**Default** +1000 = 150% of drive rating

---

## **04.07 R/W Current-limit 2**

**Range** 0 to 1000

Available as an additional current limit. Applies to both bridges. The drive can be programmed, if desired, to select 04.05 automatically at a programmed time interval after a RUN signal. Refer to 04.10, 04.18 and 04.19.

**Default** +1000 = 150% of drive rating

---

## **04.08 R/W Torque Reference**

**Range** ±1000

This value is an input to the current loop and can be selected for use in applications requiring direct control of current (motor torque).

**Default** +000

---

## **04.09 R/W Current Offset**

**Range** ±1000

Current offset is used to apply a trim to the current demand 04.01.

**Default** +000

---

## **04.10 R/W Current -limit 2 Selector**

Set 04.10 = 1 to select I-limit 2, or can be programmed to change automatically—refer to 04.18 and 04.19.

**Default** 0

---

## **04.11 R/W Current Offset Selector**

Selects the value in 04.09 as a current offset.

**Default** 0

---

## **04.12 R/W Mode bit 0**

Operates in conjunction with 04.13 to configure the drive for speed control or any of three modes of torque control. Refer to 04.13.

**Default** 0, not selected

---

## **04.13 R/W Mode bit 1**

Operates in conjunction with 04.12 to configure the drive for speed control or any of three modes of torque control, as follows—

04.12 = 0 and 04.13 = 0 Speed mode control (normal configuration)

04.12 = 1 and 04.13 = 0 Basic current- or torque-control mode.

In this mode, the torque reference 04.08 is the input to the current loop and is subject to the limitations of the over-riding current limit 04.03, the Bridge 1 and Bridge 2 limits 04.05 and 04.06, and to the current slew rate 05.04.

04.12 = 0 and 04.13 = 1 Torque-control mode with speed override. Refer to Figures 10-7 and 10-8.

In this mode, the output of the speed loop is clamped either to the value of the torque reference 04.08, or to 0—depending on whether the speed error 03.06 is positive or negative, and on whether the torque reference is positive or negative, i.e., dependent on relative polarities.

In the two motoring quadrants, speed is limited to the value of the final speed demand 03.01, preventing uncontrolled increase of speed when load is removed. The drive should be adjusted to run at a slight over-speed when off load to insure adequate current demand at all speeds.

In the two regenerative quadrants, the current demand set by torque reference 04.08 is disabled when speed is less than that set by the final speed demand 03.01. This prevents the reducing load torque resulting in reversal of rotation. The 03.01 value should be 0.



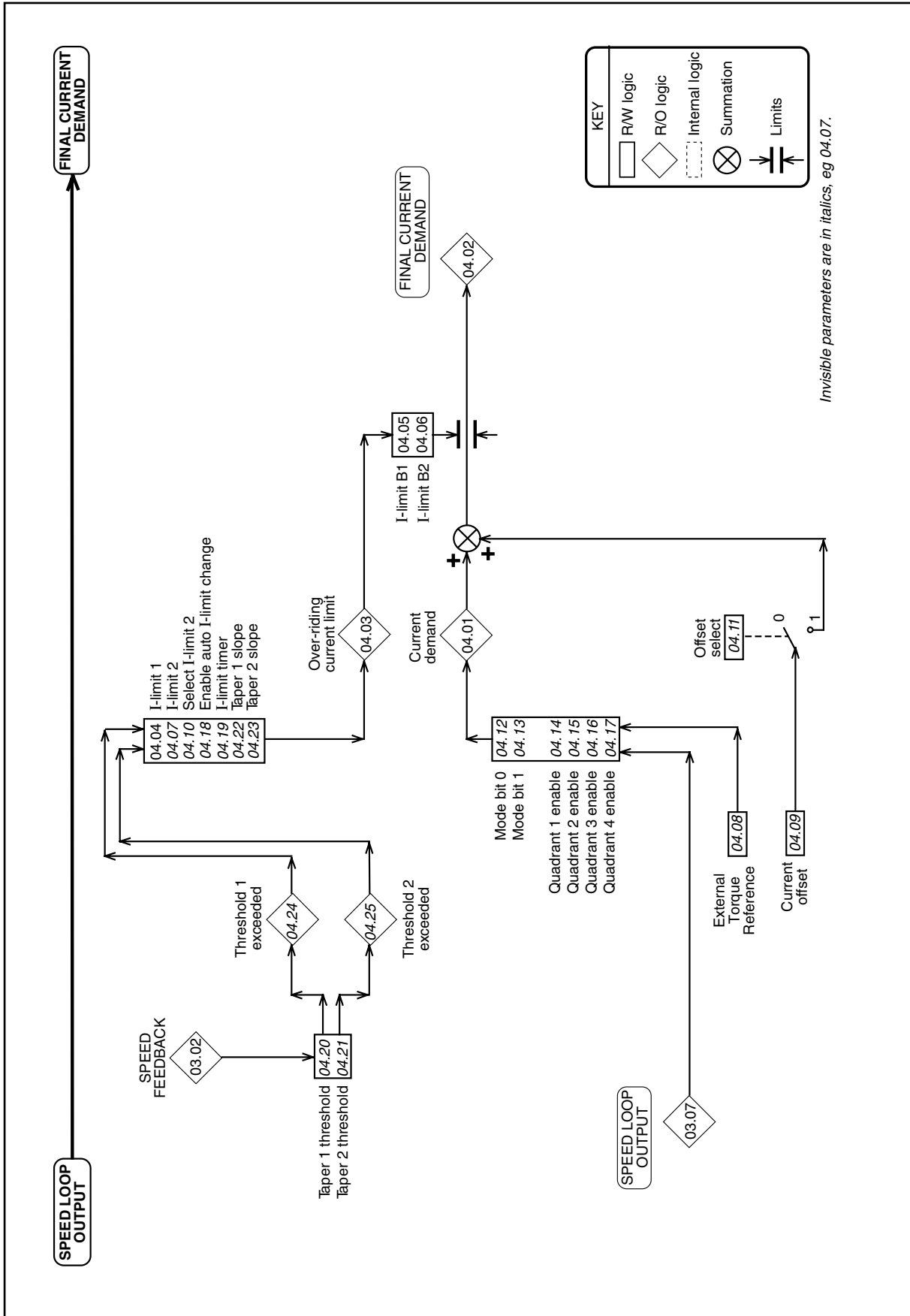
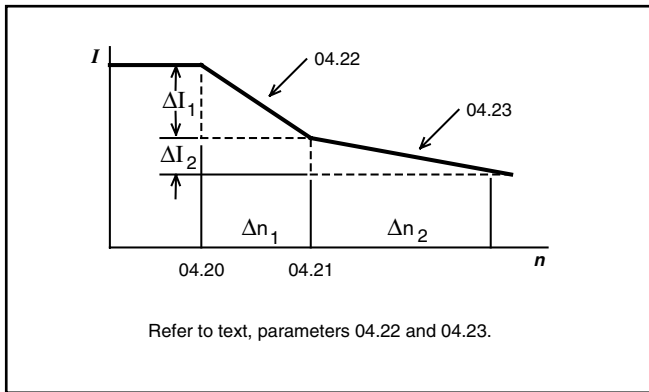


Figure 10-10. Menu 04—Current Selection & Limits

# 10 Keypad, Displays, & Drive Parameters



**Figure 10-11.**  
**Calculation of Current Taper Gradients 1 & 2.**

A disadvantage of this mode is that it cannot provide torque at a particular speed both accelerating and decelerating. Parameter *04.08* behaves as a controllable current limit in this mode.

*04.12* = 1 and *04.13* = 1 Coiler/uncoiler control mode. Refer to Figure 10-9.

This mode allows torque to be applied in either sense, for acceleration or deceleration, while preventing uncontrolled increase in speed or reversal if the load becomes 0. When the torque demand is in the sense opposite to that of speed feedback, this mode automatically selects zero speed reference.

For a coiler, the offset *01.04* should be set just slightly positive so that *03.01* is greater than the line speed reference. When a full reel (of a coiler) is decelerating, the torque demand may be negative. Since the speed feedback is positive, the speed reference is automatically made 0 so that the speed error becomes negative. Both torque demand and speed error being negative, decelerating torque is applied.

For an uncoiler, the offset *01.04* should be set just slightly negative so that there is a negative speed error at zero speed. (Negative speed error is needed to produce a negative torque to maintain tension at zero speed.) As the line speed reference increases, *03.01* becomes positive. A suitable scaling of the

input should be applied such that *03.01* is always greater than the speed feedback, thus maintaining a positive speed error *03.06*. Since the speed feedback is positive, zero speed is automatically selected whenever the torque demand is negative—normal operation—but if the torque demand becomes positive, then the *03.01* value becomes the speed demand. Accelerating torque is allowed if the reel speed is not greater than *03.01*.

For coiler/uncoiler applications, line speed reference corresponds to reel speed at *minimum* diameter.  
Default 0, not selected

---

#### *04.14 R/W Quadrant 1 enable*

Quadrant 1 operation is defined as motoring in the forward direction, speed and torque both having positive values.

Default 1, enabled

---

#### *04.15 R/W Quadrant 2 enable*

Quadrant 2 operation is defined as regenerating (braking torque) in the reverse direction, speed being negative and torque positive.

Default 1, enabled for 4Q drive

Default 0, disabled for 1Q drive

---

#### *04.16 R/W Quadrant 3 enable*

Quadrant 3 operation is defined as motoring in the reverse direction, speed and torque negative.

Default 1, enabled for 4Q drive

Default 0, disabled for 1Q drive

---

#### *04.17 R/W Quadrant 4 enable*

Quadrant 4 operation is defined as regenerating (braking torque) in the forward direction, speed being positive and torque negative.

Default 1, enabled for 4Q drive

Default 0, disabled for 1Q drive

---

#### *04.18 R/W Enable automatic current-limit 2 change*

When this bit is enabled, the I-limit 2 selector is automatically changed to 1 after a time interval set by *04.19*. The drive can be programmed to select *04.07* automatically at a programmed time interval (*04.19*) after a RUN signal.

Default 0, disabled

# 10 Keypad, Displays, & Drive Parameters

---

## 04.19 R/W Current -limit timer

Range 0 to 255

A time interval up to 255 seconds can be programmed. If 04.18=1, I-limit 2 is automatically selected when the set time elapses after a RUN command. This feature is appropriate to applications WHERE THE MOTOR IS SHORT-TIME RATED, such as mixing machinery, where the starting load is high and falls to a lower, constant value only after the machine has run for some time.

Default 000

---

## 04.20 R/W Current taper 1 threshold

Range 0 to 1000

Sets a threshold value of speed feedback, beyond which 04.24 changes to 1 to indicate that the threshold has been exceeded, and is the starting point for taper 1 (if implemented). Armature current reduces, as a function of speed, at a rate defined by 04.22. This parameter can also be used as a general purpose speed threshold.

If only one taper is used, it must be taper 1. If both are used, taper 1 must be the first.

Default +1000

---

## 04.21 R/W Current taper 2 threshold

Range 0 to 1000

Sets a threshold value of speed feedback, beyond which 04.25 changes to 1 to indicate that the threshold has been exceeded, and is the starting point for taper 2 (if implemented). Armature current reduces, as a function of speed, at a rate defined by 04.23. This parameter can also be used as a general purpose speed threshold.

Default +1000

---

## 04.22 R/W Current taper 1 slope

Range 0 to 255

Sets the rate of change of armature I-limit with respect to speed in either direction of rotation, above the threshold set by 04.20.

Scaling factor (refer to Figure 10-11):

$$04.22 = 128 \times \frac{\Delta I_1}{\Delta n_1}$$

Default 000

---

## 04.23 R/W Current taper 2 slope

Range 0 to 255

Sets the rate of change of armature I-limit with respect to speed in either direction of rotation, above the threshold set by 04.21.

Scaling factor (refer to Figure 10-11):

$$04.23 = 128 \times \frac{\Delta I_2}{\Delta n_2}$$

Default 000

---

## 04.24 RO Taper threshold 1 exceeded

Set to 1 when the threshold set point of 04.20 is exceeded.

---

## 04.25 RO Taper threshold 2 exceeded

Set to 1 when the threshold set point of 04.21 is exceeded.

# 10 Keypad, Displays, & Drive Parameters

## 10.7.5 MENU 05 — Current Loop

Refer to Figure 10-12.

This is the final stage in the processing of the speed and torque references and feedbacks to determine the final firing angle signal. The primary inputs are the final current demand, which is subject to the slew rate limit, and the current feedback which are summed algebraically and further modified by whatever settings may have been applied to the group of Current Loop parameters. Included in these parameters is the enable auto tune (05.09) which automatically sets the gains of the current loop parameters (05.12 through 05.15).

Current feedback, after scaling, delivers a readable signal to display actual current in amps. Current feedback also is an important function in the protection of the drive. The feedback signal is monitored in relation to the selected overload threshold, and modified according to preprogrammed values for overload time. The provision of two parameters for overload timing enables settings to be applied so as to take account of the fact that the cooling time of a motor can be longer than its heating time. The current and speed loops can be bypassed during start-up by (05.20), direct firing angle control.

---

### 05.01 RO Current Feedback

Range ±1000

The current feedback signal is derived from internal current transformers. It is used for closed-loop control and indication of the armature current, and to initiate motor protection.

---

### 05.02 RO Current —Displayed Feedback Amps

Range ±1999

The current feedback signal, modified by the scaling factor, becomes available as an indication in amps. Refer also to 05.05. This does not affect motor current.

---

### 05.03 RO Firing Angle

Range 277 to 1023

This is the output of the current loop algorithm, and the input reference to the ASIC, which generates the firing pulses. 05.03 = 1023 indicates fully 'phased forward'.

### 05.04 R/W Slew Rate Limit

Range 0 to 255

This parameter limits the maximum rate of change of current demand. Older types of motors, especially if of non-laminated construction, may have a tendency to flash over if the rate of change of current is too high for the inherent lag of the interpole windings.

Defined as —

$$S = I_{\max} \times 6f \times \frac{05.04}{256}$$
$$= 1.4 (I_{\max}) \times 5.04 \text{ @ } 60\text{Hz.}$$

Where,  $S$  = slew rate in amps  $s^{-1}$   
 $f$  = frequency of the power supply in Hz  
 $I_{\max}$  = max. current (A)

Default 40

---

### 05.05 R/W Current Readout Scaler

Range 0 to 1999

The maximum output current, in amps, is scaled by this parameter. This does not have any effect on the motor protection. The setting for 05.05 is calculated as follows— See paragraph 8.7 current limit set-up.

$$05.05 = \frac{I_{\max}}{10} \quad \text{if } I_{\max} > 1999\text{A}$$

$$05.05 = I_{\max} \quad \text{if } 200\text{A} < I_{\max} < 1999\text{A}$$

Default Drive current rating

---

### 05.06 R/W Overload Threshold

Range 0 to 1000

Sets the threshold of armature current feedback beyond which the current-time overload protection begins to integrate.

Default +700 = 105% of drive rating

---

### 05.07 R/W Overload Integrating Time (heating)

Range 0 to 255

Integrating time for 05.06. For use in conjunction with 05.08, such that 05.07 < 05.08.

Time  $t$  to trip is —

$$t = (05.07) \times \frac{1000 - (05.06)}{(05.01) - (05.06)}$$

Refer also to Menu 10, parameter 10.18.

Default 030 sec

---

# 10 Keypad, Displays, & Drive Parameters

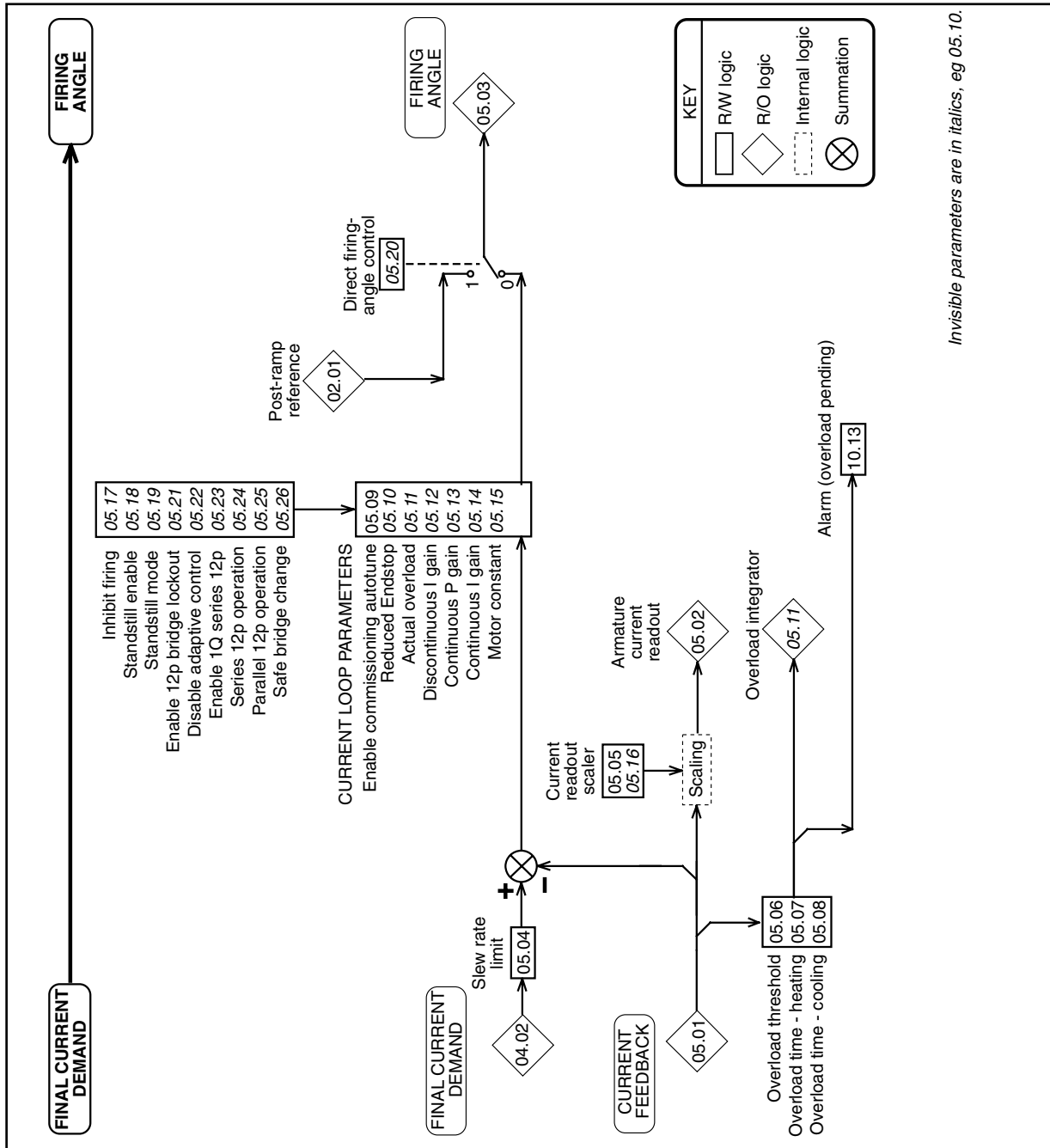
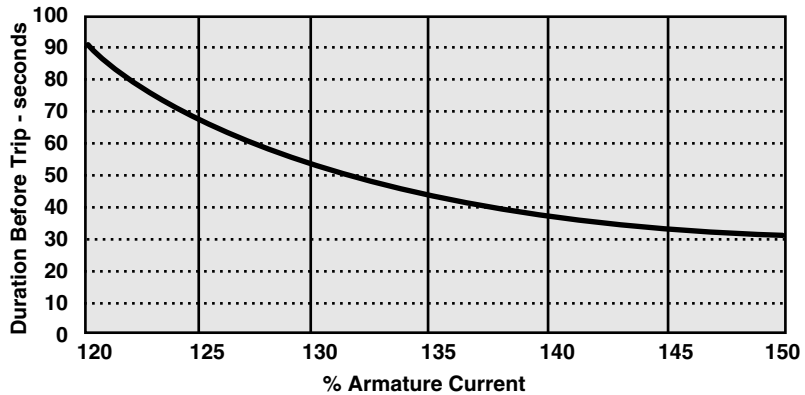


Figure 10-12.  
Menu 05—Current Loop

Figure 10-13  
Current vs.  
Time Overload Curve



# 10 Keypad, Displays, & Drive Parameters

## 05.08 R/W Overload Integrating Time (cooling)

Range 0 to 255

Integrating time for 05.06. For use in conjunction with 05.07, such that 05.08 > 05.07.

Time  $t$  to trip is —

$$t = (05.08) \times \frac{1000 - (05.06)}{(05.06) - (05.01)}$$

Refer also to Menu 10, parameter 10.18.

Default 050 sec

## 05.09 R/W Enable Autotune

To autotune the current loop during start-up—

- Disconnect the field of the motor if a fixed field is being used. Models 9500-8X01 through 9500-8X06 are standard with field control. This will disconnect the field automatically.  
**Observe approved safety procedures!**
- Enable autotune — set 05.09 = 1.
- Depress Start pushbutton to enable the drive.

When the autotune process is complete, the drive ready relay will open for 50ms after which the autotune parameter will be automatically set to disable (05.09 = 0). This process allows the autotune sequence to be started when a 'run permit' is present but returns the drive to a safe condition when the autotune is complete. It may be necessary to clamp the motor shaft if it tends to rotate during this procedure.

Default 0, disabled

## 05.10 R/W Reduced Endstop

The endstop allows the armature voltage to rise, during regeneration, to 1.16 x supply voltage. On very "soft" supplies the endstop may be too close to the crossover point. Setting 05.10=1 increases the safety margin but reduces the maximum regenerated armature voltage to 1.05 x supply voltage.

Default 0, disabled

## 05.11 RO Actual overload

Range 0 to 1999

Monitors the value of the integrating current-time overload. When the value reaches the trip point determined by 05.06, 05.07, and 05.08, an overload trip occurs. The overload trip operates when 05.11 reaches the value given by:

$$[1000 - \{05.06\}] \times \frac{10}{16}$$

The rate at which 05.11 increases or decreases is controlled by the values of 05.07 and 05.08, respectively.

## 05.12 R/W Discontinuous I-gain

Range 0 to 255

Set by the Start-up Autotune parameter 05.09.

This parameter is set to correct any errors in the prediction of firing angle in the discontinuous current region. If 05.15 is set correctly, 05.12 has little effect; but if set too high, instability can occur.

$$\text{Gain applied} = \frac{\text{value of } 05.12}{512}$$

Default 65 (ver. < 4.10); 16 (ver. ≥ 4.10)

## 05.13 R/W Continuous P-gain

Range 0 to 255

Set by the Start-up Autotune parameter 05.09.

This parameter enables the current loop to follow very closely a step-change in current. If set too high, there will be an overshoot. If set too low, the new current value will be achieved very slowly.

$$\text{Gain applied} = \frac{\text{value of } 05.13}{512}$$

Default 33 (ver. < 4.10); 16 (ver. ≥ 4.10)

## 05.14 R/W Continuous I-gain

Range 0 to 255

Set by the Start-up Autotune parameter 05.09.

Its value will depend on the motor time-constant. Increasing the value of 05.14 improves the response of the current loop, but at the risk of instability.

$$\text{Gain applied} = \frac{\text{value of } 05.14}{1024}$$

Default 33 (ver. < 4.10); 16 (ver. ≥ 4.10)

## 05.15 R/W Motor Constant

Range 0 to 255

This parameter is used to scale the current demand such that the control loop correctly predicts the firing angle in the discontinuous current region. It is set automatically by the Start-up Autotune parameter 05.09.

Default 50 (ver. < 4.10); 25 (ver. ≥ 4.10)

## 05.16 R/W RESERVED

Range 0 to 255

Default 0

## 05.17 R/W Inhibit Firing

If set to 1, disables SCR firing (both bridges), and resets acceleration and deceleration ramps.

Default 0, enabled



## 10 Keypad, Displays, & Drive Parameters

---

### 05.18 R/W Enable Standstill Logic

When enabled, causes the firing angle to be fully phased back when the drive has received a STOP command and when the speed falls below 0.8% of maximum speed. After a short time delay, the SCRs are inhibited also. This prevents “creep” and is used in applications in which there is no requirement to maintain motor torque at standstill. Refer also to 05.19.

Default 1, enable

---

### \*05.19 R/W Standstill Mode

05.19=0—standstill logic is enabled after STOP command or zero reference.

05.19=1—standstill logic enabled after STOP command only.

Setting 05.19=1 has the effect of not enabling the standstill logic when the stopping signal is given by the reference alone. This condition, therefore, allows creep speeds, shaft orientation, and other functions which occur close to zero speed, while preventing any “creep” after a STOP command.

Default 1  
0 (factory default)

---

### 05.20 R/W Enable Direct Firing Angle Control

When enabled, the firing angle 05.03 is controlled by the value of the post-ramp reference 02.01. This mode is valuable for system diagnosis, particularly where instability is present. It allows the drive to operate without the influence of either the speed loop or the current loop, eliminating their effect upon the system.

Default 0, disabled

---

### CAUTION

**This function must be used cautiously. When the reference is 02.01, there is no protection against excessive acceleration, output voltage or current other than the instantaneous overcurrent trip. Also, be sure to reset 05.20=0 after completion of tests.**

---

### 05.21 R/W Enable Bridge 2 Lockout

Requires to be set only for parallel 12-pulse 4Q system installations comprising two (2) drives which are to share load, to prevent one drive changing bridges while the other is still conducting.

Default 0, disabled

---

### 05.22 R/W Disable Adaptive Control

Setting 05.22=1 disables adaptive control.

When adaptive control is enabled (default status), the current loop employs two different algorithms, one of which applies high gain in the discontinuous-current region. This is unsuitable for some applications, such as non-motor loads, for which adaptive control should be disabled.

Default 0, enabled

---

### 05.23 R/W Enable Single-quadrant Series 12-pulse

Enabling this function configures the drive to deliver normal and delayed firing pulses to a single 12-channel power board. Cannot be enabled if either of the Bridge 2 quadrants 04.16 and 04.17 are enabled.

In 6-pulse SCR drives, the current drawn from each phase of the supply is not continuous. Out of each 180° of the AC supply cycle, full load current is drawn for 120° and none for the remaining 60°. This imposes a degree of harmonic distortion on the supply.

Twelve-pulse SCR drives draw current for the full 360° of the AC supply cycle, and the current waveform approximates very closely to a sine wave, with much reduced distortion as a result.

A further advantage is the much smoother DC output from 12-pulse drives, which is a benefit in many applications.

Two 12-channel Power Boards are driven by pcb MDA1 for 4Q series 12 pulse.

Default 0, disabled

---

### 05.24 R/W Series 12-pulse operation

This parameter should be set for operation in either single- or four-quadrant 12-pulse mode. Parameter 05.23 (see above) is read by the software only at power-on and during a cyclic reset. (This is a reset when the drive is disabled.) If either of the Bridge 2 quadrants is enabled when 05.23 is read, the outputs are not diverted within the ASIC and 05.23 is set to 0.

Default 0, disabled

---

### NOTE

Series 12-pulse mode is phase-sensitive. The rotation on the SCRs must be in the sequence L1, L2, L3 (10.11=1).

---

### 05.25 R/W Parallel 12-pulse operation

This parameter instructs the drive to operate in parallel 12-pulse mode and should be set for operation in either single- or four-quadrant mode. For 4-quadrant operation, parameter 05.21 (see above) must be set to 1. The F10 input of each drive must be connected to the ST5 output of the other. Also, the control 0V terminals of both drives must be connected.

Default 0, disabled

---

\* Refer to paragraph 10.4.2.



# 10 Keypad, Displays, & Drive Parameters

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## **05.26 R/W Extra-safe Bridge Lockout**

When enabled (=1), parameter 05.26 applies an additional safety margin to the bridge lockout logic. This may be required for highly inductive loads, such as a motor field winding.

Default 0, disabled

---

**05.27 RWB Continuous autotune (For firmware revisions  $\geq 4.09.00$ )** When enabled, an additional autotune routine continually monitors current during conduction and adjusts the current loop gains according to the amount of current ripple measured.

Default 0

---

**05.28 RWB Reduce Hysteresis or bridge changeover (For firmware revisions  $\geq 4.09.00$ )** Used to reduce hysteresis or bridge changeover in applications when fine control of current is required. When set, reduces the hysteresis to 0.2% of drive maximum current.

Default 0

---

## **05.29 R/W Burden Resistor Increase selection**

Range 0 or 1

This parameter when set allows the user to increase the HP scaling (burden) resistors by a factor of 1.6. The software scales the current feedback differently to compensate for the change in burden values.

When parameter #05.29 is set and the burdens have been changed, the minimum ripple of 0.6V on terminal 11 occurs at a feedback value of 38 in parameter #05.01 or 5.7% of drive rating.

Setting parameter #05.29 also changes the range of parameter #05.15 such that it does not have to be set close to its maximum value of 255 when continuous conduction occurs at such low currents.

Default 0

---

# 10 Keypad, Displays, & Drive Parameters

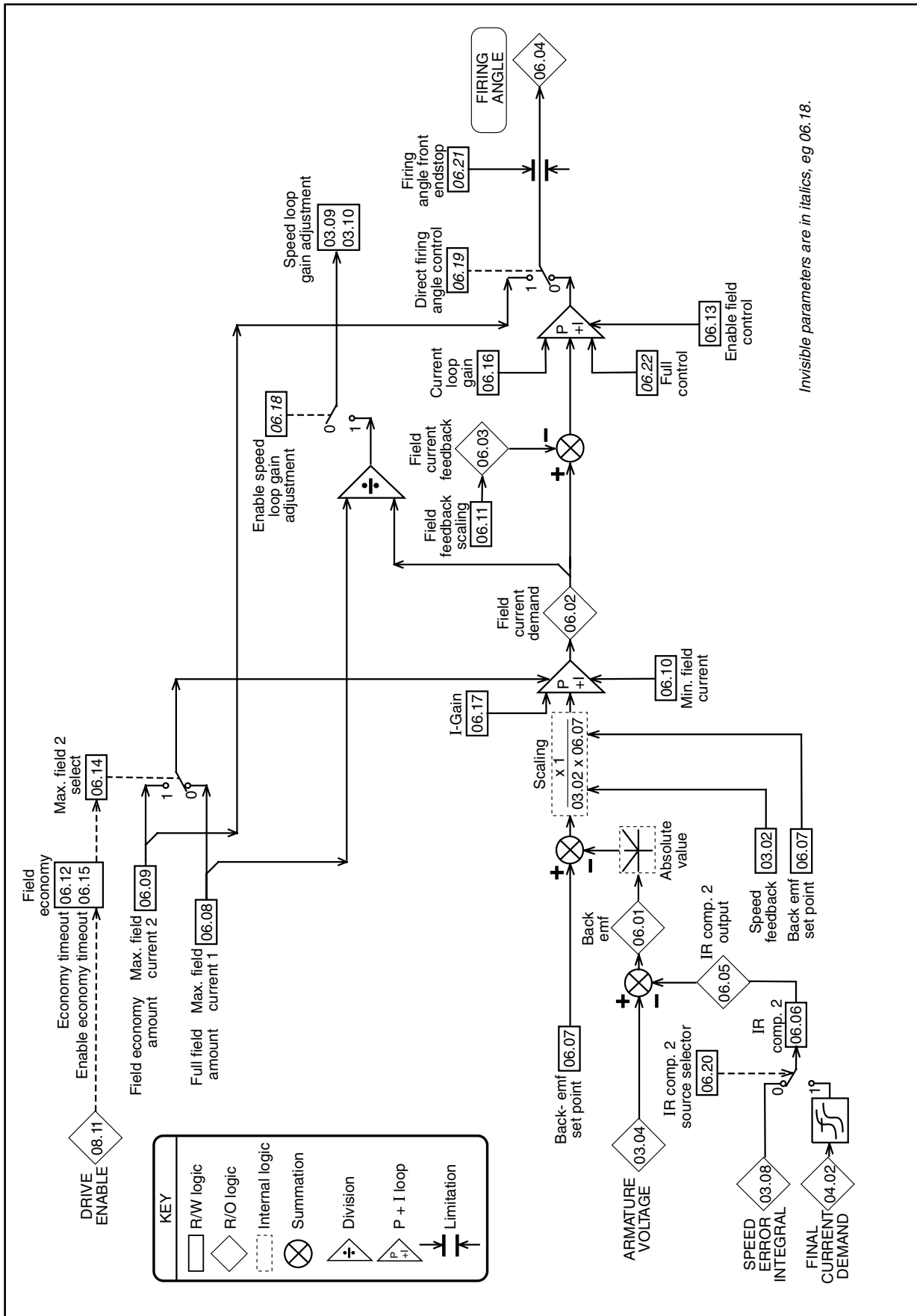


Figure 10-14.  
Menu 06—Field Control

# 10 Keypad, Displays, & Drive Parameters

## 10.7.6 MENU 06 — Field Control

Refer to Figure 10-14.

The Quantum III has an 8 amp field regulator standard on all units from 9500-8X02 through 9500-8X06. For higher HP units or fields requiring up to 20 amps, the FXM5 Field Control should be used. **If a motor is being used with a 'fixed' field supply, this menu does not apply.**

Provision is made for programming two selectable values of maximum field current. The higher value (06.08) is used to set base speed current when used as a field current regulator. The lower value of maximum field current (06.09) can be configured by a programmable timer (06.12/06.15) so that, when the drive is not running, the field can be switched automatically into the field economy mode.

The resulting field current demand is summed algebraically with the field current feedback to produce a current error which is the input to the field current loop. The output of the field current loop is the firing angle, subject to the front endstop limit (06.21). The front endstop is defaulted to 815 to prevent field over-current and roast-out.

The field current can alternatively be controlled directly by either of the maximum field parameters 06.08 and 06.09 via a programmable input or by application software. There is a facility (06.19) for direct control of the firing angle, useful for diagnosis.

The principal inputs in spillover mode are, from the internal logic, the armature voltage and a set point for back-emf.

Field current demand is the output of the back-emf voltage loop, subject to programmed maximum (06.08 or 06.09) and minimum (06.10) field current values. The voltage loop compares the calculated back-emf value with a programmed set point which is used as factor in determining field current demand. The voltage loop output, and consequently the field current demand, is maximum when the calculated back-emf is less than the setpoint value. When the calculated value exceeds the set point value (at base speed) the voltage loop reduces the field current demand to regulate the calculated back-emf to the set point value.

Alternatively, the user may wish not to use the voltage loop, but to enter a current demand directly. The user can set two maximum field current parameter values. In this mode, the value of the back-emf set point should be set to maximum, such that the voltage loop always demands maximum field current. The current demand is then the selected maximum field current parameter.

### 06.01 RO Back EMF

Range 0 to 1000

The calculated motor back emf based on armature voltage minus IR compensation value 2, 06.05. Feedback to the emf loop in spillover mode.

### 06.02 RO Field Current Demand

Range 0 to 1000

The current demand from the emf loop, subject to the limits of 06.08, 06.09 and 06.10.

### 06.03 RO Field Current Feedback

Range 0 to 1000

Feedback to the field current loop.

### 06.04 RO Firing Angle

Range 261 to 1000

Scaling —

06.04 = 1000 corresponds to 'fully phased forward'

### 06.05 RO IR Compensation 2 Output

Range ±1000

The value resulting from the application of 06.06 to the speed error integral input.

### 06.06 R/W IR Compensation 2

Range 0 to 255

A programmable factor used for calculation of the armature IR-drop as correction to measured armature voltage, to enable the back emf to be computed.

$$06.05 = \frac{(03.08) \times (06.06)}{2048}$$

Default 000

### \*06.07 R/W Back EMF Set Point

Range 0 to 1000

The programmable value of the armature back emf in volts, at which the field begins to weaken. Defined as the voltage at which base speed is reached.

Default 1000 (Quantum factory default)

\*Refer to paragraph 10.4.2.

# 10 Keypad, Displays, & Drive Parameters

## 06.08 R/W Maximum Field Current 1

Range 0 to 1000

Programmable value of the maximum current demand of the emf loop. If the field control is to be used in current mode, this parameter would become the current reference of the field control loop, and the back emf set point should normally be set to maximum to prevent spillover occurring; alternatively, if motor over-voltage protection by spillover is required, the back emf set point should be set to maximum armature voltage.

Default +1000 100% of 6.11 setting

## 06.09 R/W Maximum Field Current 2

Range 0 to 1000

Alternative to 06.07, for use as an economy setting. Refer to 06.12, 06.14 and 06.15.

Default + 500 50% of 6.11 setting

## 06.10 R/W Minimum Field Current

Range 0 to 1000

The minimum value of current demand, to prevent excessive field weakening, for example with overhauling loads.

Default + 500 50% of 6.11 setting

## 06.11 R/W Field Feedback Scaling

Range 0 to 255

The MDA3 card has a fixed scaling resistor. Parameter 06.11 permits the user to apply a scaling factor to the current feedback. Output is the value of 06.03.

Default +204 2 Amps

06.11 SETTING	J1 POSITION	MDA3 MAX. AMPS
201	2A	0.5
202	2A	1
203	2A	1.5
204	2A	2
205	8A	2.5
206	8A	3
207	8A	3.5
208	8A	4
209	8A	4.5
210	8A	5
211	8A	5.5
212	8A	6
213	8A	6.5
214	8A	7
215	8A	7.5
216	8A	8

This table is applicable for Size 1 Quantum III's only.

For FXM5 Issue 1 and Drive Software ≥ 4.0.0 For FXM5 Issue 2 and Drive Software ≥ 4.2.0				
MAXIMUM CURRENT (A)	PRIMARY TURNS N <sub>p</sub>	LK1 POSITION		PARAM. 6.11
		20 N <sub>p</sub>	15 N <sub>p</sub>	
1	10		•	1
2	10	•		2
3	5		•	3
4	5	•		4
5	4	•		5
6	3	•		6
7	2	•		7
8	2	•		8
9	2	•		9
10	2	•		10
11	1		•	11
12	1		•	12
13	1		•	13
14	1		•	14
15	1		•	15
16	1	•		16
17	1	•		17
18	1	•		18
19	1	•		19
20	1	•		20

See FXM5 User Guide for more details.

The Quantum III can also be used with an external FXM5 field regulator capable of a maximum current of 20 amps. Refer to the FXM5 Instruction Manual for DC current transformer scaling and LK1 position.

### NOTE

Software revision 4.2 or greater requires an FXM5 Revision 2 or greater. LK1 on the Quantum III power board must be cut when using the FXM5.

## 06.12 R/W Field Economy Timeout

Range 0 to 255

Permits the drive to be configured to select maximum field 2 (a reduced setting) automatically after the drive has been disabled for a period (in seconds) defined by the value chosen for this parameter. Provided so that the windings do not overheat if the drive is stopped and the motor ventilation is switched off, or to maintain a reduced level of field current to prevent condensation when the motor is not in use.

Default 030 Seconds

# 10 Keypad, Displays, & Drive Parameters

## 06.13 R/W Enable Field Control

Enables internal software control of the field current regulator.

Default 0, disabled

---

## 06.14 R/W Maximum Field 2 Selector

Set to 1 to engage maximum field 2. Controlled automatically by field economy timeout function if 06.15 is set to 1. Maximum field 2 is selected after a time delay (refer to 06.12) when a drive disable signal is given.

Default 0, disabled

---

## \*06.15 R/W Enable Field Economy Timeout

When enabled (=1), parameter 06.14 is automatically controlled by the field economy timeout function when a drive enable signal is removed. When the timeout is disabled, parameter 06.14 becomes user R/W.

Default 1, enable (Quantum factory setting)  
0, disabled (Drive default)

---

## 06.16 R/W Field Time-Constant Selector

set 06.16=1 for time constant > 0.3 sec.

set 06.16=0 for time constant < 0.3 sec.

(default)

Default 1, disabled

---

## 06.17 R/W Voltage Loop Integral Gain

Set 06.17 = 1 to double the integral gain if less overshoot is desired.

Default 0, disabled

---

## 06.18 R/W Enable Speed Gain Adjustment

This parameter adjusts the speed loop gains (menu 03) to compensate for the weakening of the field flux in field control mode so that the torque response remains substantially constant throughout the whole speed range. Defined as—

$$G = \frac{06.08}{06.02}$$

Where G = Speed loop gain adjustment factor

Default 0, disabled

---

## 06.19 R/W Direct Firing Angle Control

Enables 06.09 to control the firing angle directly, subject only to the front endstop. Permits operation without the voltage or the current loop, for the purpose of setup and troubleshooting.

Default 0, disabled

---

## CAUTION

**In this mode, there is no protection against excessive field voltage and current.**

---

## 06.20 R/W Alternative IR Comp. 2 Selector

Determines the source of the IR Compensation 2. The source selection may be either the Speed Error Integral (03.08) or the Hard Speed Reference, REF 4 (01.20).

Default 0, 03.08 1=01.20 (Ref. 4)

---

## \*06.21 R/W Firing Angle Front Endstop

Range 0 to 1000

Restricts the advance of the firing angle in cases where 180° advance would result in overvoltage being applied to the field windings.

Default 815 (Quantum factory setting)  
1000 (Drive default)

---

## 06.22 R/W Full or Half Control Selector

Provides the option of full or half control. Available only with the FXM5 Field Controller. Please refer to the FXM5 Manual for complete details.

Default 0, half control

Full control only for fast field weakening

---

## 06.23 RWB Reduce Gain by Factor 2

When enabled, reduces field loop current gain by a factor of 2. Can be used with 6.24 to reduce gains by a factor of 8.

Default 0

---

## 06.24 RWB Reduce Gain by Factor 4

When enabled, reduces field loop current gain by a factor of 4. Can be used with 6.23 to reduce gains by a factor of 8.

Default 0

---

# 10 Keypad, Displays, & Drive Parameters

---

## 10.7.7 MENU 07 —

### Analog Inputs & Outputs

Refer to Figure 10-14.

Scaling parameters have a multiplying range from 0.001 to 1.999 (a multiplier of 0 would give the parameter a zero value).

Source and Destination parameters define a parameter to be used as either input or output, thereby defining the function of the programmable input and output terminals.

Menu 07 contains three analog-input/output groupings. There are two separate groups of analog input. The first is a 12-bit analog input which is normally used as the speed reference input and assigned to TB1-3 (see Figure 10-3), but can alternatively be programmed to any real R/W destination.

High accuracy is achieved by voltage-to-frequency conversion. The terminal can be programmed as a voltage input or as a current loop input, with options 0-20mA, 20-0mA, 4-20mA, or 20-4mA. A reference encoder can also be selected as the speed reference input. This reference is scaled by 07.20 and sent to its destination by 07.15. The default is 01.17 which is the speed reference for the drive.

The second group provides a flexible means for scaling and assigning destinations to the four general purpose inputs GP1, GP2, GP3 and GP4, all of which are 10-bit resolution.

The third group consists of three analog outputs, via digital-to-analog (DAC) converters, featuring programmable-source parameters and scaling.

Finally, read only parameters are available for heatsink temperature (07.02) and RMS input voltage (07.06).

#### 07.01 RO General Purpose Input 1

Range ±1000

Displays the value of the analog signal applied to terminal TB1-04. Can be used as a general-purpose input for monitoring, or for Processor 2 special applications. 10-bit bipolar

---

#### 07.02 RO General Purpose Input 2

Range ±1000

Displays the value of the analog signal applied to terminal TB1-05. Can be used as a general-purpose input for monitoring, or for Processor 2 special applications. 10-bit bipolar

---

#### 07.03 RO General Purpose Input 3

Range ±1000

Displays the value of the analog signal applied to terminal TB1-06. Can be used as a general-purpose input for monitoring, or for Processor 2 special applications. 10-bit bipolar

---

#### 07.04 RO General Purpose Input 4

Range ±1000

Displays the value of the analog signal applied to terminal TB1-07. Can be used as a general-purpose input for monitoring, or for Processor 2 special applications. 10-bit bipolar

---

#### 07.05 RO Speed Reference Input

Range ±1000

Displays the value of the analog speed demand at terminal TB1-03, or master encoder reference via PL4, and after scaling by 07.24; dependent on reference mode being selected by 07.25. 12-bit bipolar

---

#### 07.06 RO RMS Input Voltage

Range 0 to 1000

Monitors the value of the voltage applied to line input terminals L1, L2, L3 (the SCR supply).

---

#### 07.07 RO Heatsink Temperature

Range 0 to 1000

Monitors the temperature of the SCR heatsink on those drives with installed thermistors. Readout is in degrees celsius.

---

#### 07.08 R/W DAC 1 Source

Range 0 to 1999

Selects the source of analog output 1 via terminal TB2-12. Default value 201 = 02.01, ramp output. Default 201

---

#### 07.09 R/W DAC 2 Source

Range 0 to 1999

Selects the source of analog output 2 via terminal TB2-13. Default value 302 = 03.02, speed feedback. Default 302

---

#### 07.10 R/W DAC 3 Source

Range 0 to 1999

Selects the source of analog output 3 via terminal TB2-14. Default value 304 = 03.04, armature voltage. Default 304

---

# 10 Keypad, Displays, & Drive Parameters

---

## NOTE

Concerning the following “invisible” parameters, **scaling parameters** have a multiplying range from 0.000 to 1.999. **Source and Destination parameters** define a parameter to be used as either input or output, thereby defining the function of the programmable input and output terminals.

---

### 07.11 R/W GP 1 Destination

Range 0 to 1999 (see appendix D)

Selects the destination of analog input 1 via terminal TB1-04. Default value 318=03.18, hard speed reference.

A changed value becomes effective only when the RESET pushbutton is pressed.

Default 318

---

### \*07.12 R/W GP 2 Destination

Range 0 to 1999 (see appendix D)

Selects the destination of analog input 2 via terminal TB1-05. Default value 408=4.08, speed reference 3.

A changed value becomes effective only when the RESET pushbutton is pressed.

Default 119 (factory default)

---

### \*07.13 R/W GP 3 Destination

Range 0 to 1999 (see appendix D)

Selects the destination of analog input 3 via terminal TB1-06. Default value 119=01.19, speed reference 4.

A changed value becomes effective only when the RESET pushbutton is pressed.

Default 120 (factory default)

---

### 07.14 R/W GP 4 Destination

Range 0 to 1999 (see appendix D)

Selects the destination of analog input 4 via terminal TB1-07. Default value 120=1.20, torque reference.

A changed value becomes effective only when the RESET pushbutton is pressed.

Default 408

---

### 07.15 R/W Speed Reference Destination

Range 0 to 1999

Selects the destination of speed reference 07.05. Default value 117=01.17, speed reference 1.

A changed value becomes effective only when the RESET pushbutton is pressed.

Default 117

---

### 07.16 R/W GP 1 Scaling

Range 0 to 1999

Sets the scaling for the signal from source GP1 via terminal TB1-04.

$$\text{Scaling factor} = \frac{07.16}{1000}$$

Default +1000 x 1.000

---

### 07.17 R/W GP 2 Scaling

Range 0 to 1999

Sets the scaling for the signal from source GP2 via terminal TB1-05.

$$\text{Scaling factor} = \frac{07.17}{1000}$$

Default +1000 x 1.000

---

### 07.18 R/W GP 3 Scaling

Range 0 to 1999

Sets the scaling for the signal from source GP3 via terminal TB1-06.

$$\text{Scaling factor} = \frac{07.18}{1000}$$

Default +1000 x 1.000

---

### 07.19 R/W GP 4 Scaling

Range 0 to 1999

Sets the scaling for the signal from source GP4 via terminal TB1-07.

$$\text{Scaling factor} = \frac{07.19}{1000}$$

Default +1000 x 1.000

---

### 07.20 R/W Speed Reference Scaling

Range 0 to 1999

The factor by which 07.05 is multiplied to produce the speed reference. Used to set maximum speed under defaults after feedback has been scaled.

$$\text{Scaling factor} = \frac{07.20}{1000}$$

Default +1000 x 1.000

---

\*Refer to paragraph 10.4.2.



# 10 Keypad, Displays, & Drive Parameters

## 07.21 R/W DAC 1 Scaling

Range 0 to 1999

Sets the scaling for the signal output to DAC1 TB2-12.

$$\text{Scaling factor} = \frac{07.21}{1000}$$

Default +1000 x 1.000

## 07.22 R/W DAC 2 Scaling

Range 0 to 1999

Sets the scaling for the signal output to DAC2 TB2-13.

$$\text{Scaling factor} = \frac{07.22}{1000}$$

Default +1000 x 1.000

## 07.23 R/W DAC 3 Scaling

Range 0 to 1999

Sets the scaling for the signal output to DAC3 TB2-14.

$$\text{Scaling factor} = \frac{07.23}{1000}$$

Default +1000 x 1.000

## 07.24 R/W Reference Encoder Scaling

Range 0 to 1999

Sets the scaling for signals from the reference encoder connected to terminal socket PL4. The value should be set to correspond with the maximum speed of the motor and with the number of lines-per-revolution of the encoder. To calculate the scale factor—

$$\text{Scaling factor} = \frac{750 \times 10^6}{N \times n}$$

where  $N$  = number of lines-per-revolution (encoder)  
 $n$  = max speed of motor in rpm.

Default value is determined on the basis of a 1024-line encoder, and a maximum speed of 1750 rpm.

Default +419

## 07.25 R/W Reference Encoder Selector

Selects either the analog signal at terminal TB1-03 or the encoder input via PL4 as the source of speed reference signal.

Default 0, analog reference selected

## 07.26 R/W Voltage /Current loop selector

Configures the speed input terminal (TB1-03) to accept either a voltage or a current input signal.

Default 0, voltage input selected

## 07.27 R/W 20mA Current Loop Mode Selector 1

In conjunction with 07.28, configures 20mA current loop input. Refer to table on 07.28.

Default 0

## 07.28 R/W 20mA Current Loop Mode Selector 2—Offset Selector

In conjunction with 07.27, configures 20mA current loop input. Refer to table. When a 4mA offset is used, the drive trips if it senses that the current is <3.5mA—indicating “loop open”.

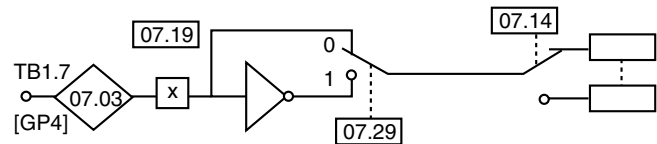
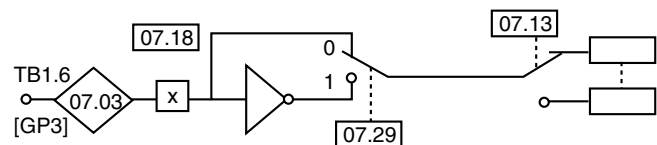
Default 1

CURRENT LOOP INPUT SELECTION		
INPUT	07.28	07.27
0-20mA	0	0
20-0mA	0	1
4-20mA	1	0
20-4mA	1	1

## 07.29 Invert Sign GP3, GP4 (for firmware revisions ≥ 4.05.0)

The R/O parameters (07.03 & 07.04) are not affected by the setting of the parameter. However, the destinations programmed by the 07.13 and 07.14 will have an opposite sign to the analogue input if the destination parameter range allows this.

Default 0



# 10 Keypad, Displays, & Drive Parameters

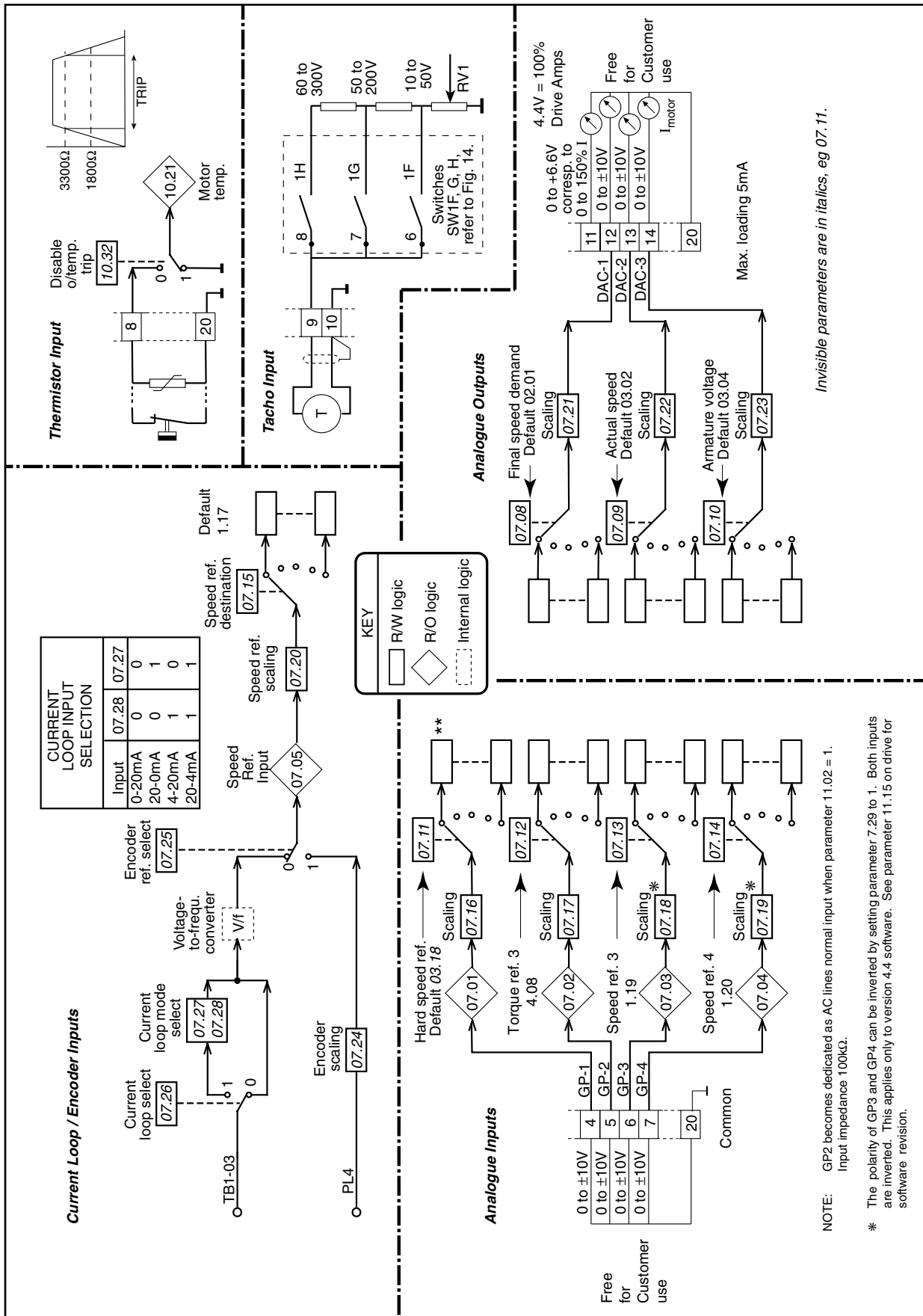


Figure 10-15. Menu 07—Analog Inputs & Outputs

\*\* See appendix D

# 10 Keypad, Displays, & Drive Parameters

## 10.7.8 MENU 08—Logic Inputs

Refer to Figure 10-15.

**Scaling parameters** have a multiplying range from 0.001 to 1.999 (a multiplier of 0 would give the parameter a zero value).

**Source and Destination parameters** define a parameter to be used as either input or output, thereby defining the function of the programmable input and output terminals.

Menu 8 contains three (3) separate input groups.

The first group is dedicated to normal drive sequencing and cannot be reassigned. It consists of:

LOCATION	PARAMETER	FUNCTION
TB3-21	08.01	Run Permit
TB3-22	08.02	Run Permit
TB3-23	08.03	Jog
TB3-31	08.11	Enable

The second group is not assigned and is freely user programmable. It consists of:

LOCATION	PARAMETER	FUNCTION
TB3-27	08.07	Unassigned
TB3-28	08.08	Unassigned
TB3-29	08.09	Unassigned
TB3-30	08.10	Unassigned

The third group is used for common drive functions and is driven by relay contacts from the 9500-4025 AC interface board. Their function may be reprogrammed to other functions via the jumpers on the 9500-4030 board.

LOCATION (9500-4025)	PARAMETER	ASSIGNED FUNCTION
TB1-11	08.04	Fwd/Rev
TB1-12	Dedicated	Drive Reset
TB3-1 on MDA2	08.06	External Trip

### NOTE

Refer to Section 9 on control logic interface for a complete description of F1 through F6 input.

### 08.01 RO F1 Input — Run Permit

0 = stop drive

1 = start enabled

Monitors the drive start-permit control input from terminal TB3-21 and indicates status. This input performs an over-riding drive stop function in speed control mode as follows —

The input must be active to permit a drive start. If the input becomes inactive, 08.01 causes the pre-ramp reference 01.03 to be set to zero. The drive will stop unless 02.03, ramp hold, is active.

### 08.02 RO F2 Input — Reference On

0 = input not active

1 = input active

Monitors the control input from terminal TB3-22 and indicates status. TB2-22 is tied to TB2-21.

### 08.03 RO F3 Input — Default Jog/ Inch Forward

0 = input not active

1 = input active

Monitors the control input from terminal TB3-23 and indicates status.

### 08.04 RO F4 Input — Default Reverse

0 = input not active

1 = input active

Monitors the control input from terminal TB3-24 and indicates status.

### 08.05 RO F5 Input — Default Reference #3

0 = input not active

1 = input active

Monitors the control input from terminal TB3-25 and indicates status.

### 08.06 RO F6 Input — External Trip

0 = input not active

1 = input active

Monitors the control input from terminal TB3-26 and indicates status.

### 08.07 RO F7 Input — User-Programmable— Unassigned

0 = input not active

1 = input active

Monitors the control input from terminal TB3-27 and indicates status.

# 10 Keypad, Displays, & Drive Parameters

**08.08 RO F8 Input — User-Programmable—**  
Unassigned  
0 = input not active                      1 = input active  
Monitors the control input from terminal TB3-28 and indicates status.

---

**08.09 RO F9 Input — User-Programmable—**  
Unassigned  
0 = input not active                      1 = input active  
Monitors the control input from terminal TB3-29 and indicates status.

---

**08.10 RO F10 Input — User-Programmable—**  
Unassigned  
0 = input not active                      1 = input active  
Monitors the control input from terminal TB3-30 and indicates status.

---

**08.11 RO Drive Enable Input—Dedicated**  
0 = disable                                      1 = enable  
Monitors the drive enable input from terminal TB4-31 and indicates status. Input must be active for the drive to operate. When the drive is disabled by disconnecting the input, all firing pulses are switched off after a 30s delay. If the drive is running when this occurs, the result is a coast-stop and ramps reset.

---

**\*08.12 R/W F2 Destination**  
Range 0 to 1999  
Defines the destination of external logic input at terminal TB3-22. Effective *only* after RESET.  
Default 111 (Quantum factory setting)  
+000 (drive default)

---

**\*08.13 R/W F3 Destination**  
Range 0 to 1999  
Defines the destination of external logic input at terminal TB3-23. Effective *only* after RESET.  
Default 113 (Quantum factory setting)  
+000 (drive default)

---

**\*08.14 R/W F4 Destination**  
Range 0 to 1999  
Defines the destination of external logic input at terminal TB3-24. Effective *only* after RESET.  
Default 112 (Quantum factory setting)  
+000 (drive default)

---

**\*08.15 R/W F5 Destination**  
Range 0 to 1999  
Defines the destination of external logic input at terminal TB3-25. Effective *only* after RESET.  
Default 115 (Quantum factory setting)  
+000 (drive default)

---

**\*08.16 R/W F6 Destination**  
Range 0 to 1999  
Defines the destination of external logic input at terminal TB3-26. Effective *only* after RESET.  
Default 1034 (Quantum factory setting)  
+000 (drive default)

---

**08.17 R/W F7 Destination**  
Range 0 to 1999  
Defines the destination of external logic input at terminal TB3-27. Effective *only* after RESET.  
Default +000

---

**08.18 R/W F8 Destination**  
Range 0 to 1999  
Defines the destination of external logic input at terminal TB3-28. Effective *only* after RESET.  
Default +000

---

**08.19 R/W F9 Destination**  
Range 0 to 1999  
Defines the destination of external logic input at terminal TB3-29. Effective *only* after RESET.  
Default +000

---

**08.20 R/W F10 Destination**  
Range 0 to 1999  
Defines the destination of external logic input at terminal TB3-30. Effective *only* after RESET.  
Default +000

---

**\*08.21 R/W Disable Normal Logic Functions**  
If set to enable (=0), this parameter configures logic inputs as follows—

F2	TB3-22	Inch Reverse
F3	TB3-23	Inch Forward
F4	TB3-24	Run Reverse
F5	TB3-25	Run Forward

If set to disable (=1), the logic inputs must be programmed by the user. Refer to 08.31 through 08.34.

If 08.21 = 0, F2/3/4/5 still perform their programmed functions.  
Default 1 = disable normal logic functions  
0 (factory default)

---

\*Refer to paragraph 10.4.2.

# 10 Keypad, Displays, & Drive Parameters

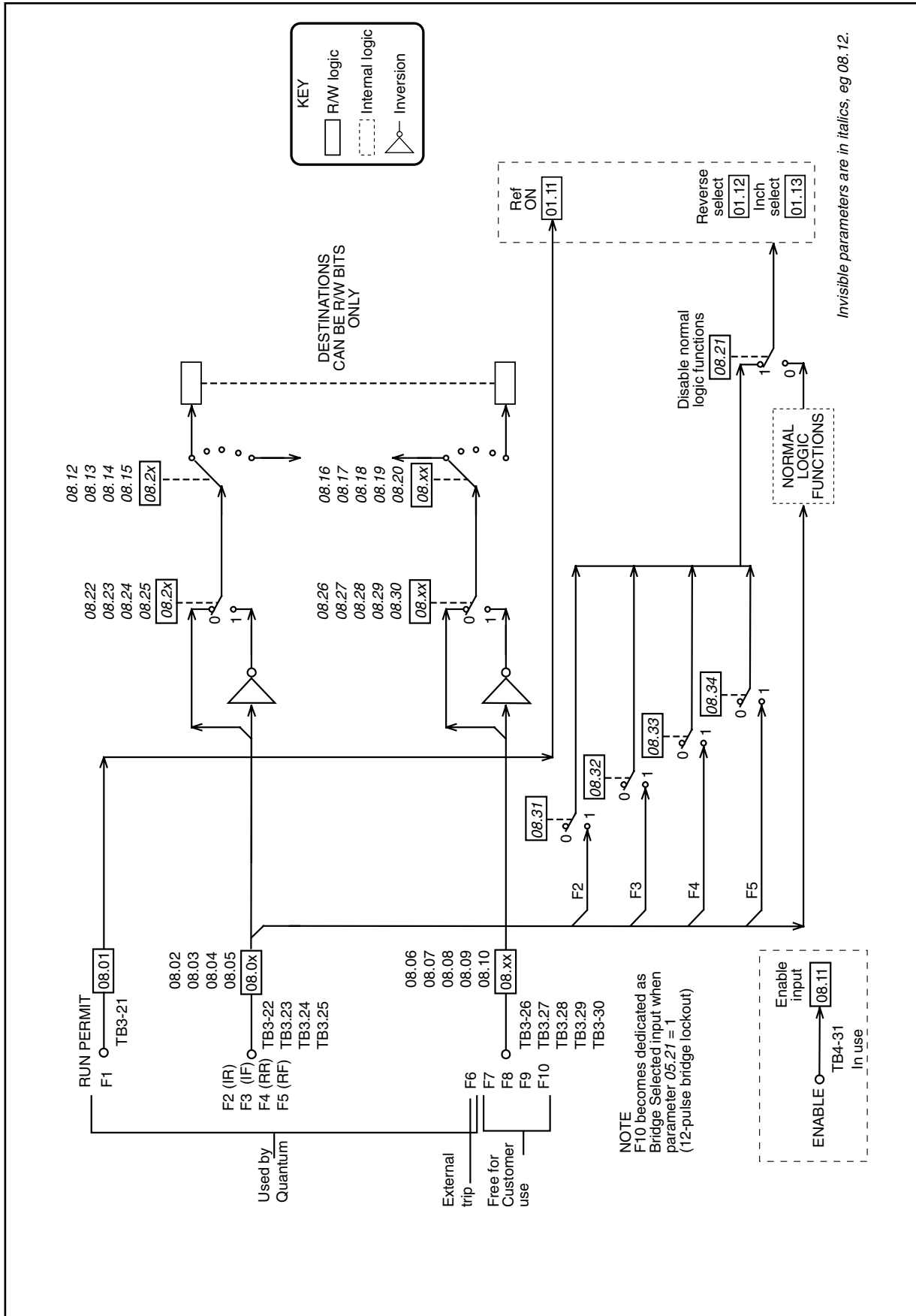


Figure 10-16.  
Menu 08—Logic Inputs

# 10 Keypad, Displays, & Drive Parameters

---

## **08.22 R/W Invert Logic Function of F2**

0 = non-invert            1 = invert

Default 0

---

## **08.23 R/W Invert Logic Function of F3**

0 = non-invert            1 = invert

Default 0

---

## **08.24 R/W Invert Logic Function of F4**

0 = non-invert            1 = invert

Default 0

---

## **08.25 R/W Invert Logic Function of F5**

0 = non-invert            1 = invert

Default 0

---

## **08.26 R/W Invert Logic Function of F6**

0 = non-invert            1 = invert

Default 0

---

## **08.27 R/W Invert Logic Function of F7**

0 = non-invert            1 = invert

Default 0

---

## **08.28 R/W Invert Logic Function of F8**

0 = non-invert            1 = invert

Default 0

---

## **08.29 R/W Invert Logic Function of F9**

0 = non-invert            1 = invert

Default 0

---

## **08.30 R/W Invert Logic Function of F10**

0 = non-invert            1 = invert

Default 0

---

## **\*08.31 R/W Enable Inch Reverse**

0 = not enable            1 = Enable inch reverse

When 08.21 = 1, normal logic functions disabled,  
08.31 can enable inch reverse.

Default 0

---

## **\*08.32 R/W Enable Inch Forward**

0 = not enable            1 = Enable inch forward

When 08.21 = 1, normal logic functions disabled,  
08.32 can enable inch forward.

Default 0

---

## **\*08.33 R/W Enable Run Reverse**

0 = not enable            1 = Enable run reverse

When 08.21 = 1, normal logic functions disabled,  
08.33 can enable run reverse.

Default 0

---

## **\*08.34 R/W Enable Run Forward**

0 = not enable            1 = Enable run forward

When 08.21 = 1, normal logic functions disabled,  
08.34 can enable run forward.

Default 0

---

\* Not applicable to Quantum III

# 10 Keypad, Displays, & Drive Parameters

---

## 10.7.9 MENU 09—Status Outputs

Refer to Figure 10-16.

Status outputs will switch five open collector transistors, each user programmable, and two relays. The drive ready is dedicated and cannot be changed. The other relay is defaulted to zero speed, but is user programmable to any other parameter.

Menu 9 contains three status source groups and each is invertible.

The first group allows the status 1 inputs from source 1 and source 2 to be combined into logic gates (OR, NOR, AND, NAND) to form PC logic. The result can be subjected to a time delay that is, in effect, in 0-1 transactions but immediate without delay in 1-0 transactions. An output is available at TB2-15. The process is duplicated with status 2 inputs and the output is at TB2-16. See Appendix C Logic Gates.

The second group selects parameters from sources ST2, ST3, and ST4 for output at terminals TB2-17, -18, and -19.

The third group selects parameters from sources ST6 and drives the form C relay at terminals TB3-35, 36, and 37.

### 09.01 RO Status 1 Output

Range 0 to 1

Status 1 output ST1 to TB2-15.

---

### 09.02 RO Status 2 Output

Range 0 to 1

Status 2 output ST2 to TB2-16

---

### 09.03 RO Status 3 Output

Range 0 to 1

Status 3 output ST3 to TB2-17.

---

### 09.04 RO Status 4 Output

Range 0 to 1

Status 4 output ST4 to TB2-18.

---

### 09.05 RO Status 5 Output

Range 0 to 1

Status 5 output ST5 to TB2-19.

---

### 09.06 RO Status 6 Relay Output

Range 0 to 1

Output to form C relay at terminals TB4-34,35,36

1 = Relay on

---

### 09.07 R/W Status 1 Source 1

Range 0 to 1999

Selects the status source to be combined with 9.09 and displayed on TB2-15.

Default +111

---

### 09.08 R/W Invert Status 1 Source 1

Range 0 to 1

Selects inversion of input on 9.07.

Default 0 (non-invert)

---

### 09.09 R/W Status 1 Source 2

Range 0 to 1999

Selects the status source to be combined with 9.07 and displayed on TB2-15.

Default 000

---

### 09.10 R/W Invert Status 1 Source 2

Range 0 to 1

Selects inversion of input on 9.09.

Default 0 (non-invert)

---

### 09.11 R/W Invert Status 1 Output

Range 0 to 1

Selects inversion of combination of 9.07 and 9.09.

Default 0 (non-invert)

---

### 09.12 R/W Status 1 Delay

Range 0 to 255 (sec.)

Sets delay time for status 1 output.

Default 0

---

### 09.13 R/W Status 2 Source 1

Range 0 to 1999

Selects the status source to be combined with 9.15 and displayed on TB2-16.

Default 1007

---

### 09.14 R/W Invert Status 2 Source 2

Range 0 to 1

Selects inversion of input on 9.13.

Default 0 (non-invert)

---

### 09.15 R/W Status 2 Source 2

Range 0 to 1999

Selects the status source to be combined with 9.13 and displayed on TB2-16.

Default 000

---



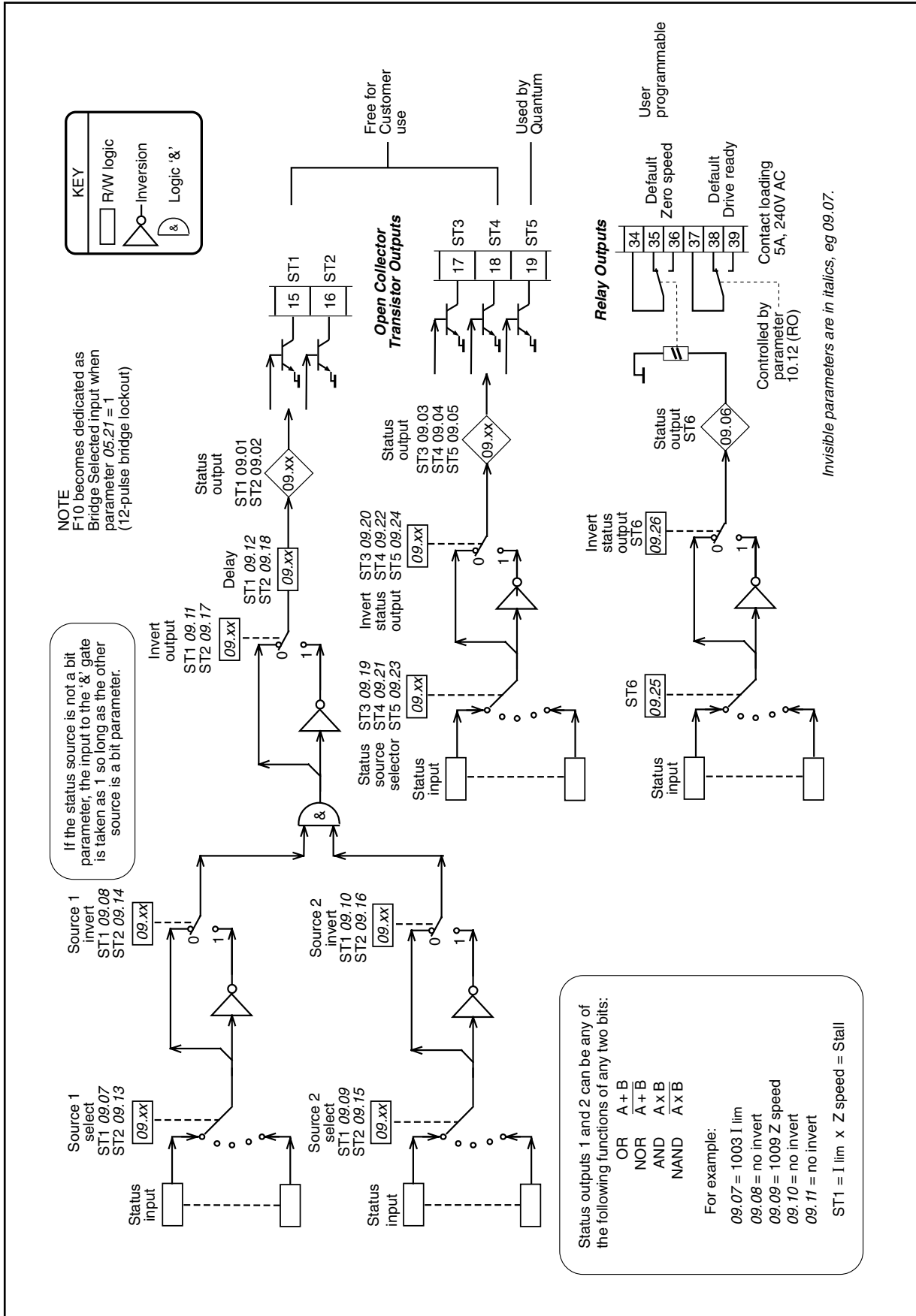


Figure 10-17.  
Menu 09—Status Outputs

## 10 Keypad, Displays, & Drive Parameters

---

### **09.16 R/W Invert Status 2 Source 2**

Range 0 to 1

Selects inversion of input on 9.15.

Default 0 (non-invert)

---

### **09.17 R/W Invert Status 2 Output**

Range 0 to 1

Selects inversion of combination of 9.13 and 9.15.

Default 0 (non-invert)

---

### **09.18 R/W Status 2 Delay**

Range 0 to 255 (sec.)

Sets delay time for status 2 output.

Default 0

---

### **09.19 R/W Status 3 Source**

Range 0 to 1999

Selects the status source to be displayed on TB2-17.

Default 1013 Overload alarm  
User programmable

---

### **09.20 R/W Invert Status 3 Output**

Range 0 to 1

Default 0 (non-invert)

---

### **09.21 R/W Status 4 Source**

Range 0 to 1999

Selects the status source to be displayed on TB3-18.

Default 1003 In current limit  
User programmable

---

### **09.22 R/W Invert Status 4 Output**

Range 0 to 1

Default 0 (non-invert)

---

### **09.23 R/W Status 5 Source**

Range 0 to 1999

Selects the status source to be displayed on TB3-19.

Default 1006 Phase back  
In use by Quantum

---

### **\*09.24 R/W Invert Status 5 Output**

Range 0 to 1

Default 1 (invert)

0 (factory default)

---

### **09.25 R/W Status 6 Source—Relay Output**

Range 0 to 1999

Selects the status to activate relay to TB4-34,35,36

Default 1009 (Zero Speed)  
User programmable

---

### **09.26 R/W Invert Status 6 Output**

Range 0 to 1

Default 0 (non-invert)

---

# 10 Keypad, Displays, & Drive Parameters

---

## 10.7.10 MENU 10 — Status Logic & Diagnostic Information

All real (not bit) RO parameters are frozen at the instant of tripping as an aid to diagnosis of the fault. They remain in this condition until the drive is reset. The last four faults are stored in 10.25 through 10.28 to form a fault history.

### 10.01 RO Forward Velocity

0 = drive stationary or running in reverse  
1 = drive running forward at >zero speed threshold

Forward direction defined as —

When tach feedback selected, terminal TB1-09 negative with respect to terminal TB1-10.

When armature voltage feedback selected, terminal A1 positive with respect to terminal A2.

When encoder feedback selected, A-channel leads B-channel.

### 10.02 RO Reverse Velocity

0 = drive stationary or running forward  
1 = drive running in reverse at >zero speed threshold

Reverse direction defined as follows —

When tach feedback selected, terminal TB1-09 positive with respect to terminal TB1-10.

When armature voltage feedback selected, terminal A1 negative with respect to terminal A2.

When encoder feedback selected, A-channel lags B-channel.

---

### **NOTE**

If 10.01 = 10.02 = 0, the motor is either stationary or running at <zero speed threshold. In this condition, 10.09 = 1 and the Zero Speed LED lights on the keypad (and RL2 is turned on, if programmed to show zero speed).

---

### 10.03 RO Current Limit

0 = drive not in current limit  
1 = drive in current limit

Indicates that the sum of the current demand 04.01 and the offset 04.09 is being limited by the current limit over-ride 04.03 or by one of the bridge limits.

---

### 10.04 RO Bridge 1 Enabled

0 = disabled                      1 = enabled

Indicates that SCR bridge 1 (the forward or positive bridge) is being fired. Does not necessarily indicate that the bridge is conducting, since conduction depends on firing angle and operating conditions.

---

### 10.05 RO Bridge 2 Enabled

0 = disabled                      1 = enabled

Indicates that SCR bridge 2 (the reverse or negative bridge) is being fired. Does not necessarily indicate that the bridge is conducting, since conduction depends on firing angle and operating conditions.

---

### 10.06 RO Electrical Phase-Back

0 = firing pulses not phased back  
1 = firing pulses phased back (at standstill)

Indicates that the firing pulses are being phased back by the action of the standstill function. Refer to 05.18 and 05.19.

---

### 10.07 RO At Speed

0 = drive not at speed                      1 = drive at speed

Indicates that the drive has attained set speed, post-ramp reference 02.01 = pre-ramp reference 01.03, and that comparison of final speed demand 03.01 with speed feedback 03.02 results in a speed error of <1.5% of maximum speed. External signal also provided through open collector output ST2 to terminal TB2-16 if source parameter 09.13 is at default setting.

---

### 10.08 RO Overspeed

0 = motor not overspeeding  
1 = motor over speed

Indicates that the speed feedback 03.02 > ±1000, that is, the speed is out of range, suggesting that the motor is being mechanically driven faster than the maximum speed of the drive. This function is a monitor only, and does not initiate a trip signal.

---

### 10.09 RO Zero Speed

0 = speed not zero                      1 = zero speed

Set if speed feedback 03.02 < zero speed threshold 03.23. Refer to 10.01 and 10.02.

---

### 10.10 RO Armature Voltage Clamp Active

0 = clamp not active                      1 = clamp active

Set when the armature voltage clamp is activated. Prevents the voltage from increasing further. Refer to 03.15.

---

# 10 Keypad, Displays, & Drive Parameters

---

## 10.11 RO Phase Rotation

0 = L1 L3 L2

1 = L1 L2 L3

Rotation is detected from L1, L2, L3.

NOTE that connection to E1 and E3 must also be correct — refer to the drawings shown in Figures A-1 through A-4 in Appendix A.

---

## 10.12 RO Drive Normal

1 = drive is powered-up and has not tripped.

---

## 10.13 RO Alarm

0 = no alarm condition present

1 = alarm condition present, impending sustained-overload trip

Indicates that the drive is in an overload condition and will eventually trip on sustained overload 10.18 if the overload condition is not removed. The time taken to trip is dependent on the settings of 05.06 and 05.07 and on the magnitude of overload.

Visual indication that the alarm has been actuated is given by the Alarm LED (flashing). External signal also provided through status logic output ST3 to terminal TB2-17—provided that source parameter 09.19 is its default value.

---

## 10.14 RO Field Loss

0 = field normal

1 = field failed

Indicates that no current is being drawn from the internal field supply (or the FXM5 optional external field control unit if installed).

---

## 10.15 RO Feedback Loss

0 = speed feedback present

1 = speed feedback absent or polarity reversed

Indicates no feedback signal, or reversed polarity. Applies to tachometer or encoder feedback, whichever is selected. Loss of feedback is not detected until the firing angle has advanced to the point where the value of 05.03 (firing angle) >767. This condition can be prevented from tripping the drive by disabling feedback loss detection 10.30.

---

## 10.16 RO Supply or Phase Loss

0 = normal

1 = supply/phase loss

Indicates loss of one or more input phases connected to L1, L2, L3. Can be disabled with 10.31.

---

## 10.17 RO Instantaneous Trip

0 = no overcurrent peak detected

1 = overcurrent peak detected

Indicates that a current peak >2 x (max. current according to the burden resistor installed) has occurred. Firing pulses are immediately suppressed, shutting the drive down.

---

## 10.18 RO Sustained Overload

0 = sustained overload not detected

1 = sustained overload detected

Indicates that current feedback 05.01 has exceeded the overload threshold 05.06 for a length of time determined by the overload time values 05.07 and 05.08 integrated with the magnitude of the overload (the conventional I x t function).

When the current exceeds the overload threshold, the excess integrates with time causing the value of the actual overload 05.11 to increase.

Conversely, if the current falls below the threshold during integration, the value of 05.11 falls towards zero. The rate of integration is set by 05.07 when the current is > threshold, and by 05.08 when the current is < threshold. The rate of integration is the trip time with full scale overload (05.01 = 1000). This function imitates the behavior of a thermal relay and simulates the thermal characteristic of a motor.

---

## 10.19 RO Processor 1 Watchdog

0 = normal

1 = trip

In normal operation of the drive, the watchdog timer is reset periodically by Processor 1 as a check that the processor and drive program are functioning normally. If a reset does not occur before the timer has timed out, the conclusion is either that the processor has failed or that the drive program has crashed. The result is immediate controlled shutdown of the drive, accompanied by a watchdog fault trip signal.

---

## 10.20 RO Processor 2 Watchdog

0 = normal

1 = trip

## 10.21 RO Motor Overtemperature

0 = normal

1 = trip

10.21 = 1 indicates trip detected at the motor thermistor input terminal.

trip level 3kΩ

detector reset level 1.8kΩ

---

# 10 Keypad, Displays, & Drive Parameters

---

## **10.22 RO Heatsink Overtemperature**

0 = normal 1 = trip

10.22 = 1 indicates SCR heatsink overtemperature, >100°C (on drives installed with an SCR heatsink thermistor).

---

## **10.23 RO Speed Loop Saturated**

0 = speed loop not saturated

1 = speed loop saturated

Indicates that the output of the speed loop algorithm, from which the current demand 04.01 is derived, is at a limit. This may be due to the application of a current limit or a zero-current clamp, and may occur if the motor is mechanically stalled.

---

## **10.24 RO Zero Current Demand**

0 = current demand > 0

1 = current demand = 0

Indicates that the current demand signal is being limited to zero. This could occur, for example, as a result of a sudden loss of load, the drive being in torque control mode with speed over-ride. The speed could reach the set speed threshold as a consequence, causing the speed loop to reduce the current demand to zero.

---

## **10.25 RO Last Trip**

Range 0 to 255

Record of the last-trip code, forming the basis of a trip history.

---

## **10.26 RO The Trip Before the Last Trip (10.25)**

Range 0 to 255

Record of the trip before that which is saved in 10.25.

---

## **10.27 RO The Trip Before 10.26**

Range 0 to 255

Record of the trip before that which is saved in 10.26.

---

## **10.28 RO The Trip Before 10.27**

Range 0 to 255

Record of the trip before that which is saved in 10.27. The four parameters 10.25 to 10.28 provide a permanent memory of the last four trips. They are updated only by a new trip occurring.

---

## **10.29 R/W Disable Field Loss Trip**

Prevents the drive from tripping when field loss is detected; for example, in applications where the internal field supply is not used (as with permanent magnet motors) or is switched off when the drive is not running.

Default 0, field loss trip enabled

---

## **10.30 R/W Disable Feedback Loss Trip**

Prevents the drive from tripping when speed feedback loss is detected, for example, in certain load-sharing applications and in applications which do not involve motors, such as battery charging and other electrolytic processes.

Default 0, feedback loss enabled

---

## **10.31 R/W Disable Supply or Phase Loss Trip**

Prevents the drive from tripping when supply or supply phase loss is detected, allowing the drive to ride through brief supply interruptions.

Default 0, supply/phase loss enabled

---

## **10.32 R/W Disable Motor Overtemperature Trip**

Prevents the drive from tripping when motor temperature sensor input changes to high resistance, for example when motor overtemperature protection is used in the alarm mode, or to achieve a line normal stop.

Default 1, motor overtemperature trip disabled

---

## **10.33 R/W Disable Heatsink Overtemperature Trip**

Prevents the drive from tripping when heatsink temperature sensor detects a temperature greater than 100°C, for example, when heatsink overtemperature protection is used in the alarm mode, or to achieve a system normal stop.

Default 0, heatsink overtemperature trip enabled  
1, for models 9500-8X02,8X03

---

## **10.34 R/W External Trip**

If 10.34 = 1, the drive trips. If an external trip is required, the user can program any logic input to control this bit (refer to Menu 08). Alternatively, it can be controlled by application software or through the serial interface.

Default 0

---

# 10 Keypad, Displays, & Drive Parameters

## 10.35 R/W Processor 2 Trip

Range 0 to 255

If the drive is normal, the data display for 10.35 is 0. The value of 10.35 is continuously monitored by the processor. The drive trips immediately if a non-zero value (other than 255) appears via the serial communications interface, or Processor 2 software.

If 10.35 = 255, this is the equivalent of a RESET.

Default 0

## 10.36 R/W Disable Current Loop Loss Trip

When 10.36 = 1, the trip which normally follows current loop loss is disabled.

Default 0

## 10.37 R/W Disable Armature Open Circuit Trip

(For firmware revisions  $\geq$  4.02.00)

When 10.37 = 1, the trip which normally follows armature open circuit is disabled. This is used for non-motor applications such as the drive being used as a front end bridge to an inverter.

Default 0

## 10.7.11 MENU 11— Miscellaneous

### \*User-Defined Menu

Parameters 11.01 through to 11.10 define the parameters in the user-defined Menu 00. For example, if the user wishes parameter 00.01 to display speed in rpm (03.03), parameter 11.01 (corresponding to 00.01) should be set to 303. Other miscellaneous parameters are also defined.

The following parameters are programmed in the menu and can be changed at any time.

### QUANTUM FACTORY SETTINGS

ACCESSED AT	PARAMETER DESCRIPTION	PARAMETER NUMBER
0.01	Armature Voltage	3.04
0.02	Armature Current	5.02
0.03	Motor RPM	3.03
0.04	Speed Reference	1.02
0.05	AC Line Voltage	7.06
0.06	Max Speed	1.06
0.07	Jog Speed	1.05
0.08	Forward Acceleration	2.04
0.09	Forward Deceleration	2.05
0.10	Current Limit	4.05

## 11.11 R/W Serial Address

Range 0 to 99

Defines the unique address of a drive when several are connected to common serial bus in a multidrop application. If set  $\geq$  100, the value is taken as 99.

Default 001

## 11.12 R/W Baud Rate

Range 0 to 1

Two Baud rates are available for the communications interface with the standard drives. Enter the 'setting' number appropriate to the required Baud rate as shown —

Baud	Setting
4800	0
9600	1

Default 0

\*Refer to paragraph 10.4.2.



# 10 Keypad, Displays, & Drive Parameters

## 11.13 R/W Serial Mode

Range 1 to 4

Defines the mode of operation of the serial port. There are four modes. Enter the 'setting' number appropriate to the required mode as shown —

Mode	Setting
ANSI protocol	1
Output variable defined by 11.19	2
Input variable into parameter defined by 11.19	3
Wide integer (16-bit) driver	4

**Mode 1** is for communication between the drive and another serial device (terminal, plc, computer).

**Mode settings 2 and 3** are for rapid transfer of information between two drives, avoiding the need for analog signals to pass between them. For example, mode settings 2 and 3 could be used in a load-sharing application to output the current demand from one drive in Mode 2 and input a current demand to another in Mode 3.

In **Mode 4** the drive will output the wide integer 15.63 to the transmit lines, and put any received data into 15.62. This permits a digital reference to be transmitted down a line of drives, and offers the possibility of setting ratios at each stage. Data must be transferred from 15.62 to 15.63 by a BASIC program. If a Wide Integer is read from the serial comms interface, the data is sent as five ASCII characters with no sign. (The full range of parameters can be written by five ASCII characters if no sign is included.) Data is transferred by mode 4 at the rate of 3X mains frequency.

Default 001

## 11.15 RO Processor 1 Software Version

Range 0 to 255

Displays the revision number of the software installed in Processor 1. For example, version 1.0.0 is displayed as 10 (data window).

## 11.16 RO Processor 2 Software Version

Range 0 to 255

Reserved for processor 2 special application software (MD21 option PCB).

## 11.17 R/W Level 3 Security Code

Range 0 to 255

If this parameter is changed (to any value other than 0 or 149) and stored, the value set must be entered into parameter 0 to return the drive to its "as-delivered" state. Level 1 or 2 security must then be used in the normal way. If 11.17 is set = 0, all parameters are freely read-write, accessible without the need to enter a security code. To store, set parameter 00 = 1 and press RESET.

Default 149

## 11.18 R/W Boot-up Parameter

Range 0 to 1999

Used for setting the parameter displayed at the keypad at power-on.

Default +000

## 11.19 R/W Serial Programmable Source

Range 0 to 1999

Defines an output or input parameter when serial mode 2 or 3 is selected. Refer to 11.13.

Default +000

## 11.20 R/W Serial Scaling

Range 0 to 1999

Scales the input data in serial mode 3. Refer to 11.13.

Default +1000

## 11.21 R/W LEDs Byte

Range 0 to 255

Designations—

- Bit 7 Alarm
- Bit 6 Zero speed
- Bit 5 Run forward
- Bit 4 Run reverse
- Bit 3 Bridge 1
- Bit 2 Bridge 2
- Bit 1 At speed
- Bit 0 Current limit

The displayed value is the decimal equivalent of the bit-pattern.

## 11.22 R/W Disable Normal LED Functions

Disables the normal functions of the keypad LED indicators (with the exception of *Drive Ready*) and renders them programmable. By setting 11.22 = 1, normal LED functions (with the exception of *Drive Ready*) can be controlled via the serial interface or processor 2 special application software. The LEDs display the binary equivalent of the value in 11.21.

Default 0, enabled

## 11.23 R/W Permissive for MDA210 Rev. 3

If the MDA210 Rev. 3 power board is used for a high voltage Quantum III, this parameter must be set to 1.

Default 0 1 = MDA210 Rev. 3

## 11.24

Deals with line dip ride-through.

Leave Default as a 0. Consult your Drive Center or Technical Support for more information if necessary.

Default 0



# 10 Keypad, Displays, & Drive Parameters

---

## 10.7.12 MENU 12 — Programmable Thresholds

Refer to Figure 10-18.

This menu allows parameters to be selected and compared to a settable threshold level. Hysteresis can be added and the result inverted, if required, and sent to an internal destination or to the status menu 09.

**12.01 RO Threshold 1 Exceeded**  
0 = normal                      1 = threshold exceeded

---

**12.02 RO Threshold 2 Exceeded**  
0 = normal                      1 = threshold exceeded

---

**12.03 R/W Threshold 1 Source**  
Range 0 to 1999  
Default + 302

---

**12.04 R/W Threshold 1 Level**  
Range 0 to 1000  
Default + 000

---

**12.05 R/W Threshold 1 Hysteresis**  
Range 0 to 255  
Default 002

---

**12.06 R/W Invert Threshold 1 Output**  
0 = default                      1 = signal inverted

---

**12.07 R/W Threshold 1 Destination**  
Range 0 to 1999  
Default + 000

---

**12.08 R/W Threshold 2 Source**  
Range 0 to 1999  
Default + 501

---

**12.09 R/W Threshold 2 Level**  
Range 0 to 1000  
Default + 000

---

**12.10 R/W Threshold 2 Hysteresis**  
Range 0 to 255  
Default 002

---

**12.11 R/W Invert Threshold 2 Output**  
0 = default                      1 = signal inverted

---

**12.12 R/W Threshold 2 Destination**  
Range 0 to 1999  
Default + 000

---

## 10.7.13 MENU 13 — Digital Lock

Refer to Figure 10-19.

When the Digital Lock feature of the Quantum III is required, a small change in the programmable logic inputs must be made. Since the drive in its standard configuration uses logic input F2 (terminal #22) for "Reference On," it imposes a conflict with the F2 input, "Inch Reverse" (parameter #8.02) of this menu. To eliminate this conflict, the following changes should be made:

1. Move the wire connection to terminal #22 (MDA1 board) to terminal #27.
2. Reprogram the logic input F2 (set parameter #8.12 to 000).
3. Program the logic input F7 destination to Reference On (set parameter #8.17 to 111).

To program these parameters, enter the security code (200) into any X.00 menu; then make the changes in Steps 2 and 3 above. When this is done, press drive reset; then perform a store sequence (menu X.00 to 1 and then reset). This completes the setup.

**13.01 RO Master Encoder (Reference Encoder) Value**  
Range 0 to 1023

---

**13.02 RO Slave Encoder (Feedback Encoder) Value**  
Range 0 to 1023

---

**13.03 RO Master Counter Increment**  
Range ±1000

---

**13.04 RO Slave Counter Increment**  
Range ±1000

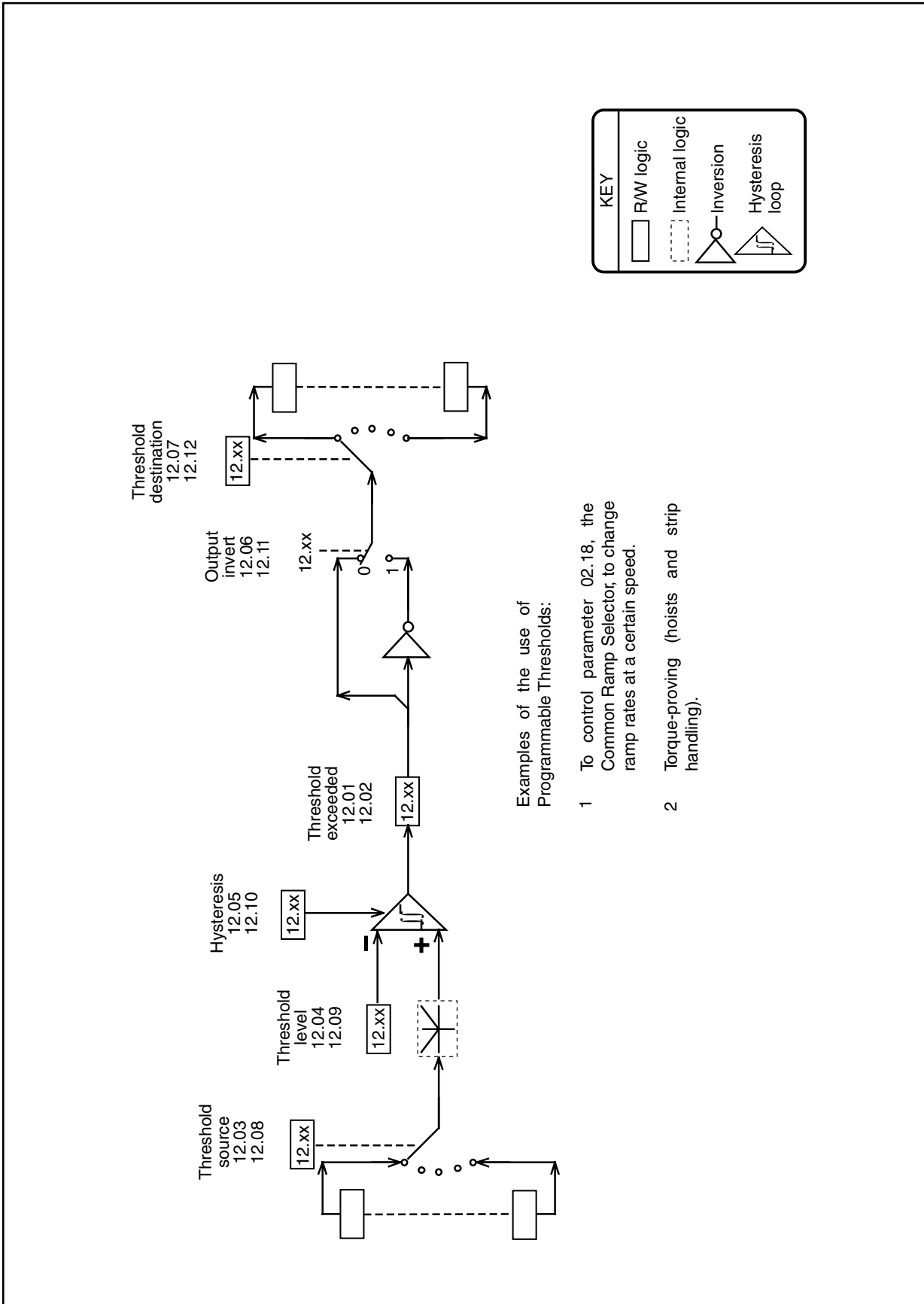
---

**13.05 RO Position Error**  
Range 0 to 255  
Indicates the difference between the positions of the motor shaft and the slave shaft.

---

**13.06 R/W Precision Reference**  
Range 0 to 255  
See also **13.07, 13.12, and 13.13.**

---



Examples of the use of Programmable Thresholds:

- 1 To control parameter 02.18, the Common Ramp Selector, to change ramp rates at a certain speed.
- 2 Torque-proving (hoists and strip handling).

Figure 10-18.  
Menu 12—Programmable Thresholds (Qty-2)

# 10 Keypad, Displays, & Drive Parameters

---

## 13.07 R/W Precision Reference

Range 0 to 255

See also 13.06, 13.12, and 13.13.

Parameters 13.06 and 13.07 are used, in conjunction with each other, to define a 16-bit velocity reference when parameter 13.12 = 0.

Parameter 13.06 is the least-significant component.

Parameter 13.07 is the most-significant component.

Each unit of 13.07 represents 256 increments of 13.06.

---

## 13.08 R/W Precision Loop Gain

Range 0 to 255

Determines the amount of velocity correction per unit of position error. The setting thus determines how quickly the loop responds to a disturbance, and thus affects the motor output shaft position.

This parameter must be adjusted in conjunction with the Speed Loop PID Gains 03.09, 03.10 and 03.11 to attain the best balance between stability and quick response.

---

## 13.09 R/W Position Loop Correction Limit

Range 0 to 1000

Limits the amount of the velocity-correction resulting from a position error.

---

## 13.10 R/W Position Loop Software Enable

0 = disabled 1 = enabled

Enables the Position Loop software.

---

## 13.11 R/W Rigid Lock Enable

0 = disabled 1 = enabled

When 13.11 = 1, the position error, relative to the time the position loop is closed, is always absolute. Therefore, if the slave output shaft is slowed down by an overload, position is regained by an automatic speed increase when the load reduces to or below maximum.

When 13.11 = 0 (default), the Position Loop is closed only when the "At Speed" condition is reached. This allows the accelerating ramps to be used without overspeeding the slave output shaft.

---

## 13.12 R/W Reference Source

1 = master encoder 0 = precision reference

Determines the source of the digital loop reference, as between the master encoder (13.01) or the precision references (13.06 and 13.07).

---

## 13.13 R/W Precision Reference Latch

0 = use last values 1 = use updated values

The two Precision Reference values, 13.06 and 13.07, cannot be changed simultaneously. To prevent the Position Loop reading inconsistent values during the change, parameter 13.13 = 0 (default) enables the Position Loop to continue to use the last values while the change is occurring. When a change of both 13.06 and 13.07 has been completed, setting 13.13 = 0 causes the updated values to be applied. 13.13 should then be reset to 0, ready for the next update.

---

## 13.14 R/W Precision Speed Reference (16-bit)

Range 000 to 65,535

This parameter is a "wide integer" equivalent to the Precision Reference 13.06 and 13.07. It allows the precision reference to be written as a single statement, removing the need for the latch, parameter 13.13.

Parameter 13.14 is intended mainly for use through serial communications.

---

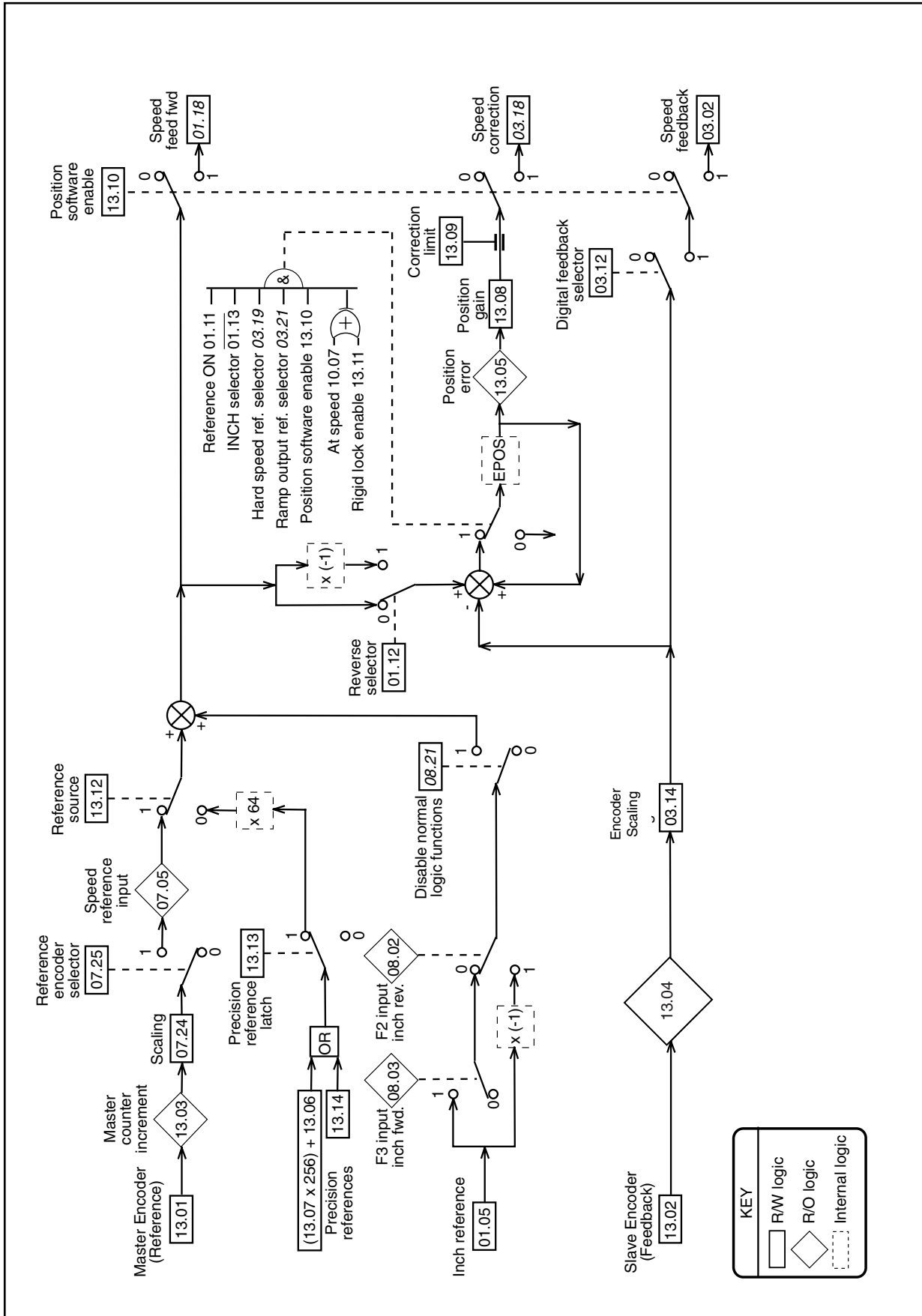
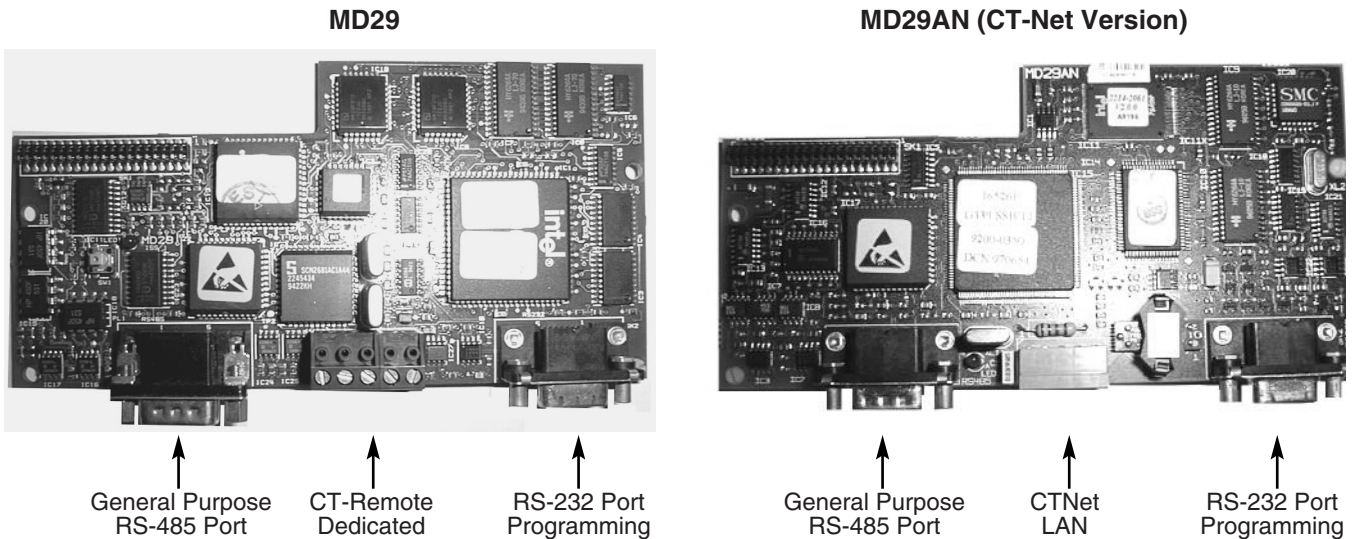


Figure 10-19.  
Menu 13—Digital Lock

# 10 Keypad, Displays, & Drive Parameters

## 10.7.14 Menu 14 Optional MD29 Set-Up Parameters

Listed below are a group of parameters governing the operation of the MD-29 and MD-29AN Co-Processors. Specific details about these parameters can be found in the MD29 Manual.



Number	Description	Range	Type	Default	Security	Comment
14.01	ANSI Serial Address			1		
14.02	RS485 Mode			1		
14.03	RS485 Baud Rate			48		For modes 1, 5-9
14.04	Clock task time-base-mSec			0		
14.05	CTNet Node ID (MD29AN only)			0		
14.06	Auto-Run on Power-up Enable			1		
14.07	Global Run-time Trip Enable			1		
14.08	CT Remote I/O Trip Link Enable-RS-485			0		For CT Remote I/O Module
14.09	Enable Watchdog Trip			0		
14.10	Enable Trip on Parameter Write Overrange			1		Recommend Enable
14.11	Disable Toolkit Communications			0		For SyPT Toolkit Comms
14.12	Internal Advanced Position Controller Enable			0		Not Menu 13
14.13	I/O Link Synchronization			0		For CT Remote I/O Module
14.14	Encoder Timebase Select			0		
14.16	Flash Memory Store Request			0		
14.17	Drive → Drive Communications RS232			0		

**Note:** These parameters take effect only after an MD29 or Drive Reset or thru DPL code with the REINIT command.

For additional details on these parameters, consult the MD29 Manual (Part # 0400-0027) or within the help sections of the SyPT toolkit.

# 10 Keypad, Displays, & Drive Parameters

## 10.7.15 MENU 15 — Optional Application Menu 1

For parameter values, please refer to the following list.

Number	Description	Range	Type	Default	Security	Comment
15.01	RO variable 1	±1999	RO		None	
15.02	RO variable 2	±1999	RO		None	
15.03	RO variable 3	±1999	RO		None	
15.04	RO variable 4	±1999	RO		None	
15.05	RO variable 5	±1999	RO		None	
15.06	Real R/W variable 1	±1999	R/W	+ 000	Level 1	
15.07	Real R/W variable 2	±1999	R/W	+ 000	Level 1	
15.08	Real R/W variable 3	±1999	R/W	+ 000	Level 1	
15.09	Real R/W variable 4	±1999	R/W	+ 000	Level 1	
15.10	Real R/W variable 5	±1999	R/W	+ 000	Level 1	
15.11	Integer R/W variable 1	0 to 255	R/W	000	Level 1	
15.12	Integer R/W variable 2	0 to 255	R/W	000	Level 1	
15.13	Integer R/W variable 3	0 to 255	R/W	000	Level 1	
15.14	Integer R/W variable 4	0 to 255	R/W	000	Level 1	
15.15	Integer R/W variable 5	0 to 255	R/W	000	Level 1	
15.16	Integer R/W variable 6	0 to 255	R/W	000	Level 1	See 15.60 and 15.61
15.17	Integer R/W variable 7	0 to 255	R/W	000	Level 1	
15.18	Integer R/W variable 8	0 to 255	R/W	000	Level 1	
15.19	Integer R/W variable 9	0 to 255	R/W	000	Level 1	
15.20	Integer R/W variable 10	0 to 255	R/W	000	Level 1	
15.21	Bit variable 1	0 or 1	R/W	0	Level 1	
15.22	Bit variable 2	0 or 1	R/W	0	Level 1	
15.23	Bit variable 3	0 or 1	R/W	0	Level 1	
15.24	Bit variable 4	0 or 1	R/W	0	Level 1	
15.25	Bit variable 5	0 or 1	R/W	0	Level 1	
15.26	Bit variable 6	0 or 1	R/W	0	Level 1	
15.27	Bit variable 7	0 or 1	R/W	0	Level 1	
15.28	Bit variable 8	0 or 1	R/W	0	Level 1	
15.29	Bit variable 9	0 or 1	R/W	0	Level 1	
15.30	Bit variable 10	0 or 1	R/W	0	Level 1	
15.31	Bit variable 11	0 or 1	R/W	0	Level 1	
15.32	Bit variable 12	0 or 1	R/W	0	Level 1	
15.33	Bit variable 13	0 or 1	R/W	0	Level 1	

## 10 Keypad, Displays, & Drive Parameters

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### Menu 15 — Optional Applications Menu 1 (Cont.)

Number	Description	Range	Type	Default	Security	Comment
15.34	Bit variable 14	0 or 1	R/W	0	Level 1	
15.35	Bit variable 15	0 or 1	R/W	0	Level 1	
15.36	Bit variable 16	0 or 1	R/W	0	Level 1	
15.60	Ratio 1 wide integer = 15.16 & 15.17	0 to 255	R/W	000	Level 1	Used w/ digital lock MD29 program
15.61	Ratio 2 wide integer = 15.18 & 15.19	0 to 255	R/W	000	Level 1	
15.62	Serial mode 4 input data		RO		Level 1	
15.63	Serial mode 4 output data		RO		Level 1	

#### **15.60** Ratio 1

This parameter is the equivalent of parameters 15.16 and 15.17, such that Ratio 1 in the Digital Lock software can be written simultaneously, removing the need for the latch, 15.31.

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#### **15.61** Ratio 2

This parameter is the equivalent of parameters 15.18 and 15.19, such that Ratio 2 in the Digital Lock software can be written simultaneously, removing the need for the latch, 15.31.

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#### **15.62** Serial 'Mode 4' Input Data

When serial (interface) Mode 4 is selected, this parameter is loaded with a variable input from the serial (interface) port. Refer also to parameter 11.13.

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#### **15.63** Serial 'Mode 4' Output Data

When serial (interface) Mode 4 is selected, this parameter is transmitted to the next drive down the line.

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## 10 Keypad, Displays, & Drive Parameters

### 10.7.16 MENU 16 — Optional Application Menu 2

For parameter values, please refer to the following list.

Number	Description	Range	Type	Default	Security	Comment
16.01	RO variable 1	±1999	RO		None	
16.02	RO variable 2	±1999	RO		None	
16.03	RO variable 3	±1999	RO		None	
16.04	RO variable 4	±1999	RO		None	
16.05	RO variable 5	±1999	RO		None	
16.06	Real R/W variable 1	±1999	R/W	+ 000	Level 1	
16.07	Real R/W variable 2	±1999	R/W	+ 000	Level 1	
16.08	Real R/W variable 3	±1999	R/W	+ 000	Level 1	
16.09	Real R/W variable 4	±1999	R/W	+ 000	Level 1	
16.10	Real R/W variable 5	±1999	R/W	+ 000	Level 1	
16.11	Integer R/W variable 1	0 to 255	R/W	000	Level 1	
16.12	Integer R/W variable 2	0 to 255	R/W	000	Level 1	
16.13	Integer R/W variable 3	0 to 255	R/W	000	Level 1	
16.14	Integer R/W variable 4	0 to 255	R/W	000	Level 1	
16.15	Integer R/W variable 5	0 to 255	R/W	000	Level 1	
16.16	Integer R/W variable 6	0 to 255	R/W	000	Level 1	
16.17	Integer R/W variable 7	0 to 255	R/W	000	Level 1	
16.18	Integer R/W variable 8	0 to 255	R/W	000	Level 1	
16.19	Integer R/W variable 9	0 to 255	R/W	000	Level 1	
16.20	Integer R/W variable 10	0 to 255	R/W	000	Level 1	
16.21	Bit variable 1	0 or 1	R/W	0	Level 1	
16.22	Bit variable 2	0 or 1	R/W	0	Level 1	
16.23	Bit variable 3	0 or 1	R/W	0	Level 1	
16.24	Bit variable 4	0 or 1	R/W	0	Level 1	
16.25	Bit variable 5	0 or 1	R/W	0	Level 1	
16.26	Bit variable 6	0 or 1	R/W	0	Level 1	
16.27	Bit variable 7	0 or 1	R/W	0	Level 1	
16.28	Bit variable 8	0 or 1	R/W	0	Level 1	
16.29	Bit variable 9	0 or 1	R/W	0	Level 1	
16.30	Bit variable 10	0 or 1	R/W	0	Level 1	
16.31	Bit variable 11	0 or 1	R/W	0	Level 1	
16.32	Bit variable 12	0 or 1	R/W	0	Level 1	
16.33	Bit variable 13	0 or 1	R/W	0	Level 1	
16.34	Bit variable 14	0 or 1	R/W	0	Level 1	
16.35	Bit variable 15	0 or 1	R/W	0	Level 1	
16.36	Bit variable 16	0 or 1	R/W	0	Level 1	

