TRANE TR200 Drive Startup

Startup Procedures

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Objectives

Student will be able to:

- Identify the reference material needed for a startup and where that material may be found
- Safely apply power to the drive
- Navigate the LCP, and display basic programming skills
- Identify the different terminal blocks on the drive
- Connect control wiring for various control schemes used in HVAC applications
- Safely check motor rotation and operation
- Copy parameter settings to LCP

Reference Material

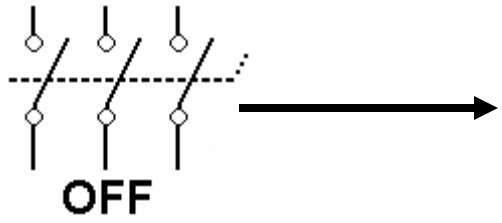
Specific instruction manual (IM) shipped with each drive

Programming guide & other documentation available for download

Instruction Manual Contents

- Safety
- Technical data
- Dimensions
- Installation
- Operation
- Programming
- Alarm and warning messages
- Examples of use
- List of different functions and drive options

DANGER



Touching the electrical parts may be fatal — even after the equipment has been disconnected from the AC line. To be sure that the capacitors have fully discharged, you may have to wait ***up to*** 40 minutes.

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ARC FLASH WARNING

- BE AWARE OF THE HAZARD
- BE TRAINED ON ARC FLASH
- USE PROPER TEST & PROTECTIVE EQUIPMENT

Applying Power

- Double check to ensure all wiring is correct
- Measure line voltage to be applied to the input side of the VLT unit (terminals L1, L2 and L3) to verify it is within +/- 10% of the rated input voltage
- Ensure fuses are correct and in place
- Ensure all run and speed commands are off or at zero
- Power is ready to be switched on

LCP Features

Other benefits

- Removable during operation
- Up/download from one drive to another
- IP65 rating when mounted in panel door
- Numerical display available

Graphical display

- Shows bars and graphs
- Displays international symbols
- 27 languages available

LED indicators

Menu structure

- Based on matrix system
- Easy shortcuts
- Edit and operate in different setups simultaneously

Quick menus

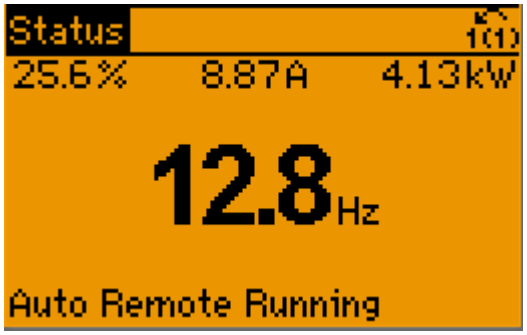
- Choose from Danfoss or personalized quick menus
- Application setup menus

Special keys

- Info (on board manual)
- Cancel (undo)
- Alarm log (quick access)

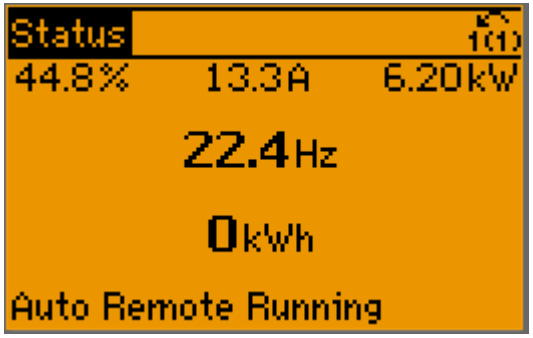
Status Modes

Display up to 4 variables

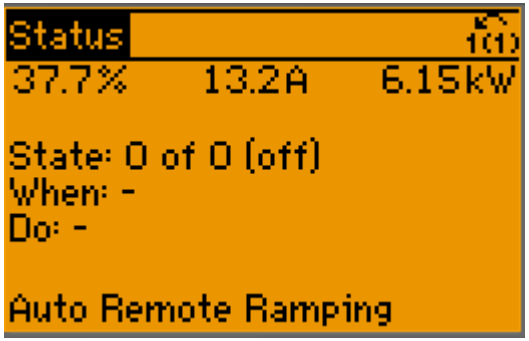


Toggled with status key

Display up to 5 variables

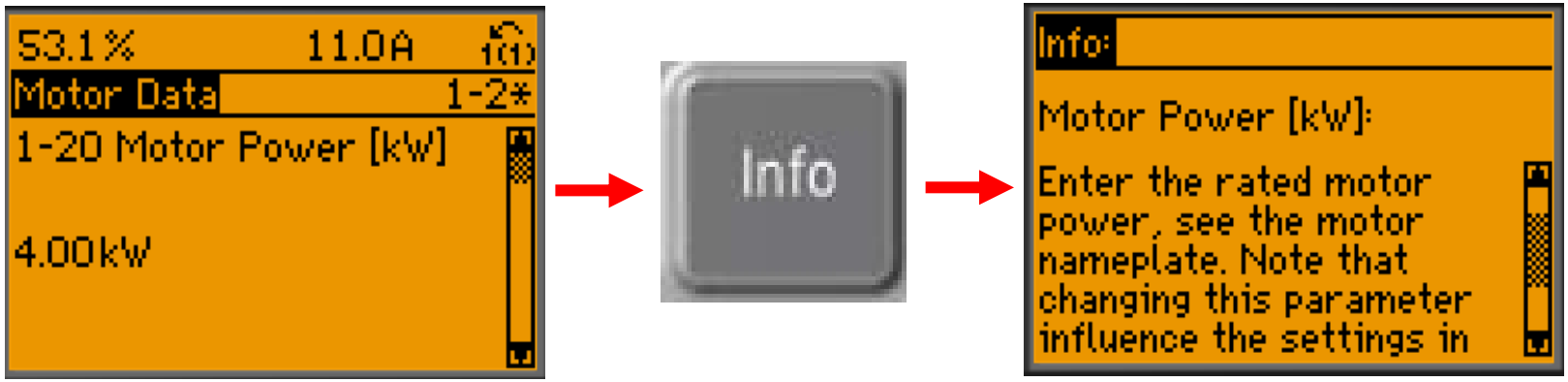


Display the smart logic controller



Info Key

- Parameter descriptions
- Onboard manual
- Press the key when in the alarm log for information
- Press the key when displaying the “Status” screen to show the display layout



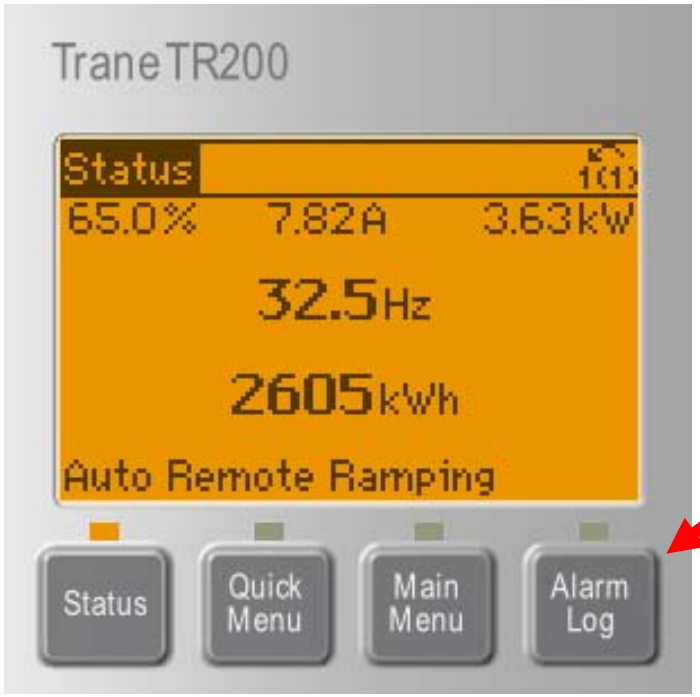
Cancel Key & Back Key

- Pressing the "**Cancel**" Key will undo the change to a parameter that was just made.

- Pressing the "**Back**" Key will undo the change to a parameter that was just made.

Alarm Log Key

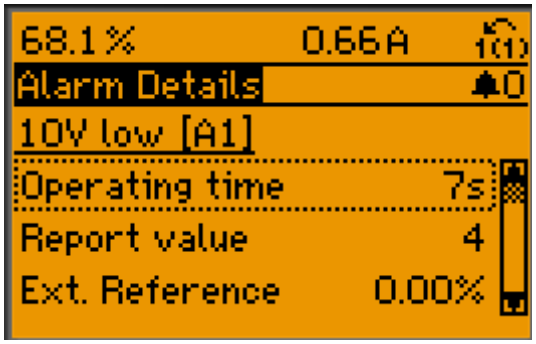
- Alarm Log shows the last 10 alarms

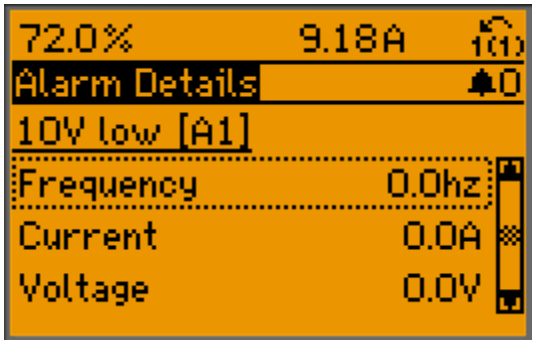


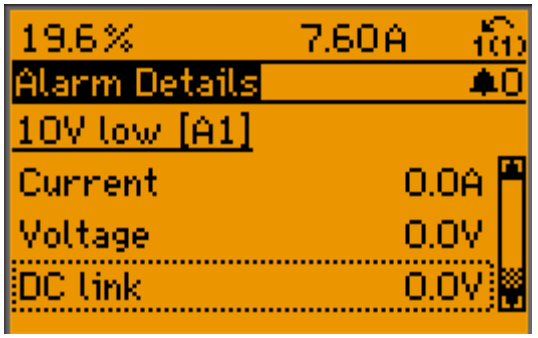
Easy, one-key access to the Alarm Log

Alarm Log Data

- Operating time
- Report value
- External reference
- Frequency
- Current
- Voltage
- DC link







Resetting “Trip” & “Triplock” Alarms

- Pressing the **“Reset”** key during a “Trip” alarm condition will clear the alarm
- “Triplock” alarms can only be reset after cycling input power
- Parameter 14-20/14-21 enables/disables automatic reset

Controlling the VFD

There are 3 different ways to control the drive

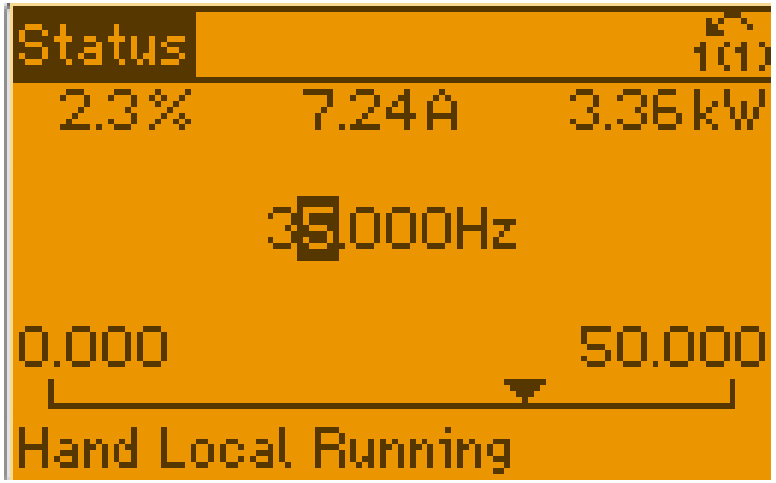
1 – Local control or “Hand Mode” using the LCP

2 – Remote control using remote I/O signals (digital & analog)

3 – Remote control using various serial communication protocols

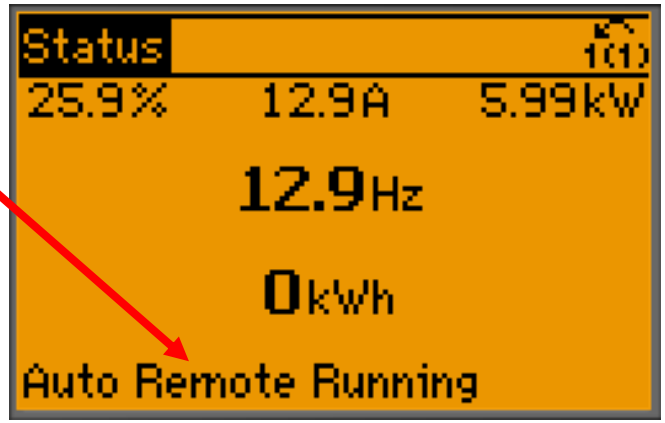
Hand On Key

- Starts drive by hand; one jumper wire is needed
- Keypad accepts local reference in RPM or Hz



Auto On Key

- Run the drive with remote control
- Open or closed loop
- Start command & speed referenced needed
- Drive status display

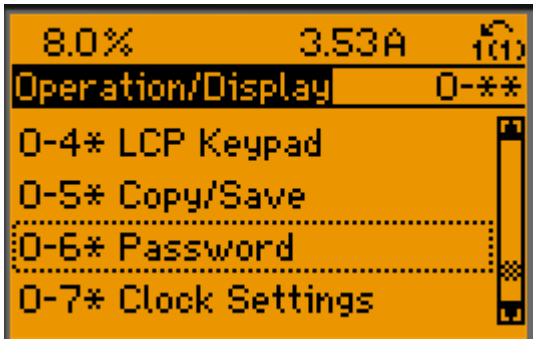


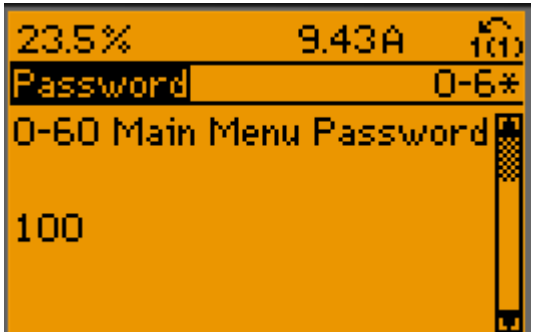
LCP Copy

- Set parameter 0-50 to “All to LCP” to load your setup from the drive into the LCP memory
- Copy process initiates upon pressing “OK” key
- Select “All from LCP” to copy settings back from the LCP into the drive

Keypad Lock

- Setup parameters for locking the keypad in the 0-6 parameter group
- Limit access to Main Menu and or Personal Menus
- Can be temporarily bypassed





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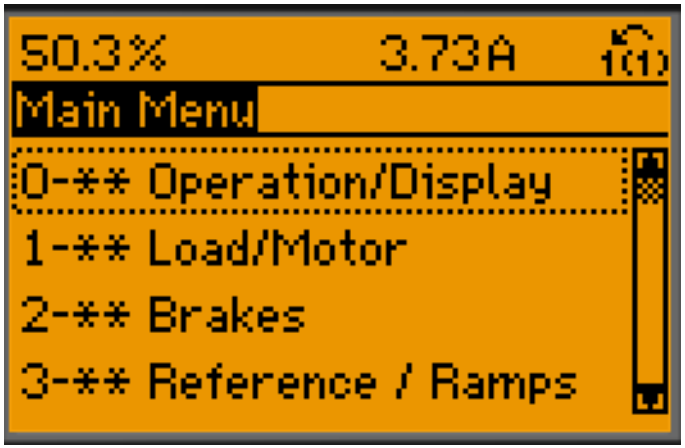
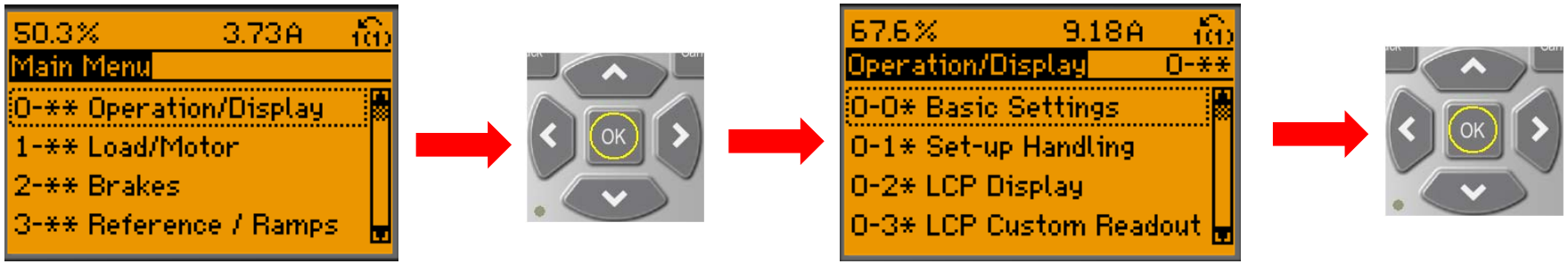
LCP Menu Navigation

Use the arrow keys to scroll through the menus:



LCP Menu Navigation

- The OK key confirms your choices
- 20 seconds to confirm



Now find your parameter and hit OK to select it

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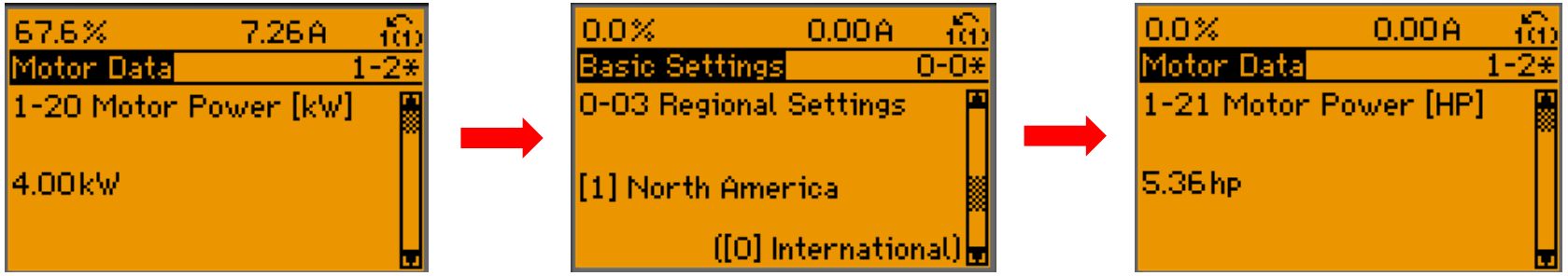
Initialization (Factory Reset)

- First, remove power
- Hold these keys while reapplying power:
  - Status
  - Main Menu
  - OK
- Alarm 80 – Reset

Programming: Regional Settings

- Changing parameter 0-03 will change units from International to North American
- Kilowatts change to horsepower in this example



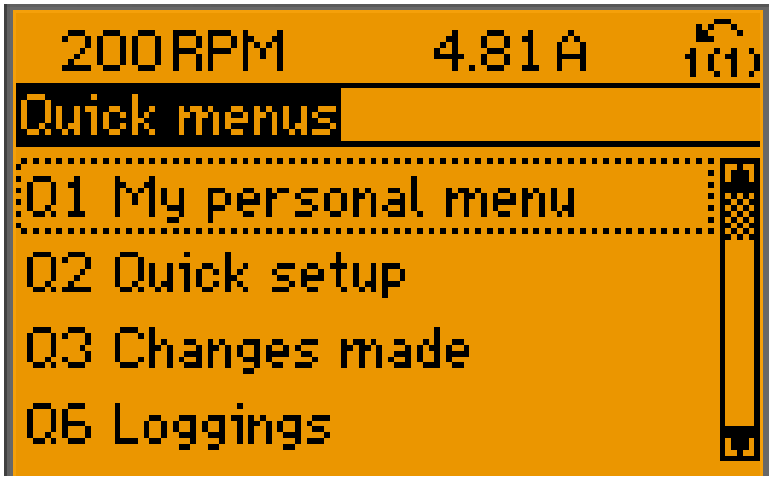
Programming: Parameter Groups

- 0 – Operation and Display
- 1 – Load and Motor
- 2 – Brakes
- 3 – Reference / Ramps
- 4 – Limits / Warnings
- 5 – Digital In / Out
- 6 – Analog In / Out
- 8 – Comm. and Options
- 13 – Smart Logic
- 14 – Special Functions
- 15 – Drive Information
- 16 – Data Readouts
- 18 – Info & Readouts
- 20 – Drive Closed Loop
- 21 – Ext. Closed Loop
- 22 – Application Functions
- 23 – Time Based Functions
- 24 – Application Functions 2

Programming: Quick Menus

Press the ***Quick Menu*** key to access the Quick Menus

- My personal menu
- Quick Setup
- Function Setups
- Changes Made
- Loggings



Programming: Quick Menus

My Personal Menu

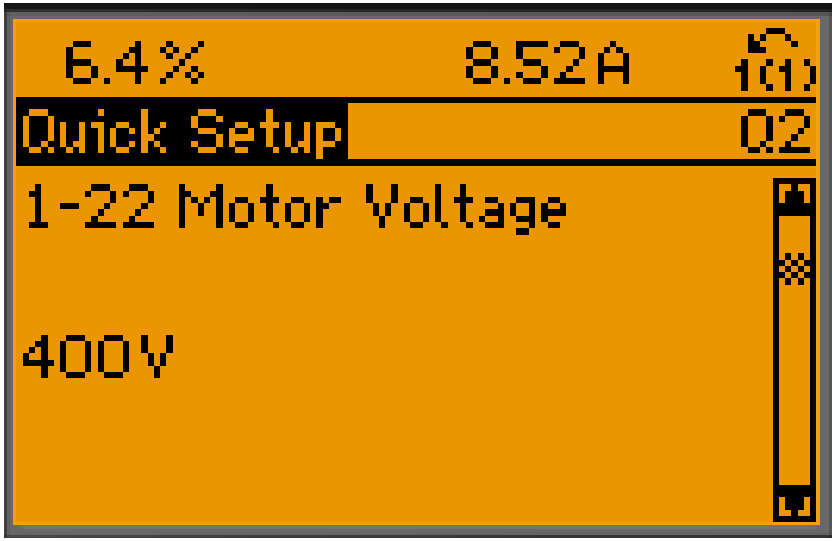
- Allows the user to display and edit up to 20 chosen parameters
- Set up in parameter 0-25

Programming: Quick Menus

Quick Setup

Use the arrow keys to scroll through the **14** Quick Setup parameters:

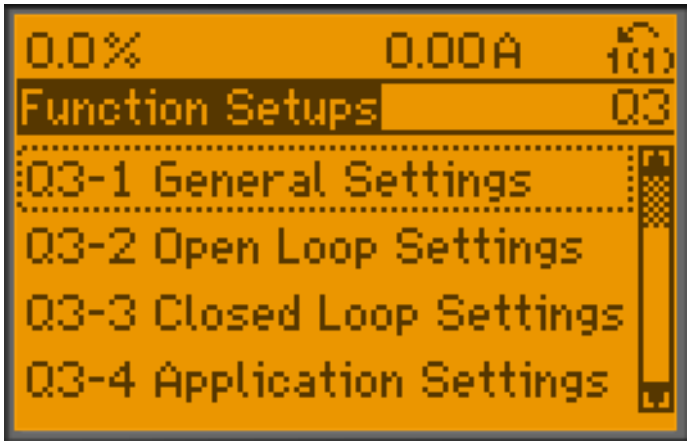
- 0-01 Language
- 1-20 Motor Power
- 1-22 Motor Voltage
- 1-23 Motor Frequency
- 1-24 Motor Current
- 1-25 Motor Speed
- 1-28 Check Motor Rotation
- 3-41 Ramp 1 Ramp Up Time
- 3-42 Ramp 1 Ramp Down Time
- 4-12 Motor Speed Low Limit Hz
- 4-14 Motor Speed High Limit Hz
- 3-11 Jog Speed
- 5-12 Terminal 27 Digital Input Function
- 5-40 Relay Function



Programming: Quick Menus

Function Setups

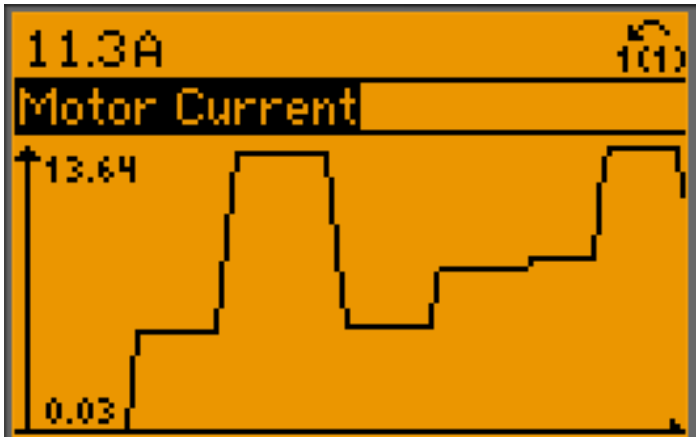
- Q3-1 General Settings
- Q3-2 Open Loop Setting
- Q3-3 Closed Loop Settings
- Q3-4 Application Settings



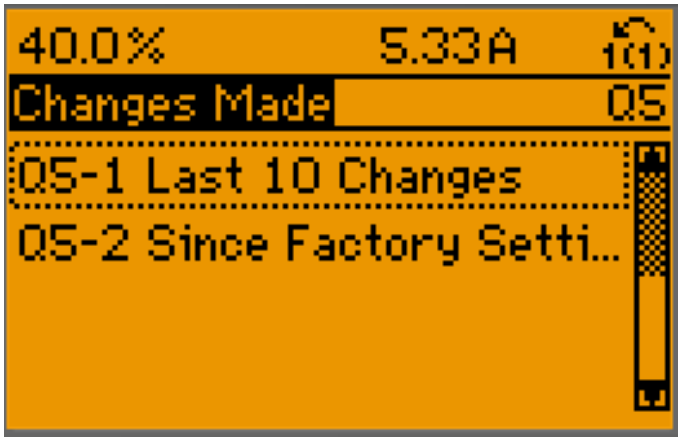
Programming: Quick Menus

Provides quick access to setting up your motor and encoder parameters

Loggings



Changes Made



Programming: Motor Parameters

- 1-21 Motor Rated Power
- 1-22 Motor Rated Voltage
- 1-23 Motor Frequency
- 1-24 Motor Rated Full Load Current
- 1-25 Motor Rated Speed
- 1-28 Motor Rotation Check
- 1-29 Automatic Motor Adaptation (AMA)

NOTE: Parameters must be programmed in order

Programming: AMA Procedure

- All motor data must be entered correctly via parameters (1-21) – (1-25)
- Set parameter 1-29 for “Enable Complete AMA”
- Press “Hand On” to start
- Press “OK” key to finish
- “Alarm (50 – 58) if AMA fails; if this occurs, then perform AMA again using “Enable Reduced AMA”

BREAK TIME

"I, along with some of the other employees, feel you're abusing the break room."

Control I/O

- Digital inputs
- Analog inputs
- Analog/digital outputs
- Digital outputs (relays)
- Programmable
- Expandable

The following describes the functions of the control terminals. Many of these terminals have multiple functions determined by parameter settings. Some options provide additional terminals. See Figure 2-2.

Terminal No.	Function
01, 02, 03 and 04, 05, 06	Two Form C output relays. Maximum 240 VAC, 2 A. Minimum 24 VDC, 10 mA or 24 VAC, 100 mA. Can be used for indicating status and warnings. Physically located on power card.
12, 13	24 VDC power supply to digital inputs and external transducers. The maximum output current is 200 mA.
18, 19, 27, 29, 32, 33	Digital inputs for controlling the drive. R = 2 kohm. Less than 5 V = logic 0 (open). Greater than 10 V = logic 1 (closed). Terminals 27 and 29 are programmable as digital/pulse outputs.
20	Common for digital inputs.
37	0-24 VDC input for safety stop (some units).
39	Common for analog and digital outputs.
42	Analog and digital outputs for indicating values such as frequency, reference, current and torque. The analog signal is 0/4 to 20 mA at a maximum of 500 Ω. The digital signal is 24 VDC at a minimum of 500 Ω.
50	10 VDC, 15 mA maximum analog supply voltage for potentiometer or thermistor.
53, 54	Selectable for 0 to 10 VDC voltage input, R = 10 kΩ, or analog signals 0/4 to 20 mA at a maximum of 200 Ω. Used for reference or feedback signals. A thermistor can be connected here.
55	Common for terminals 53 and 54.
61	RS-485 common.
68, 69	RS-485 interface and serial communication.

Term	18	19	27	29	32	33	37	53	54	42	1-3	4-6
Para	5-10	5-11	5-12	5-13	5-14	5-15	5-19	6-1*	6-2*	6-5*	5-4*	5-4*

Table 2.2: Control Terminals and Associated Parameter

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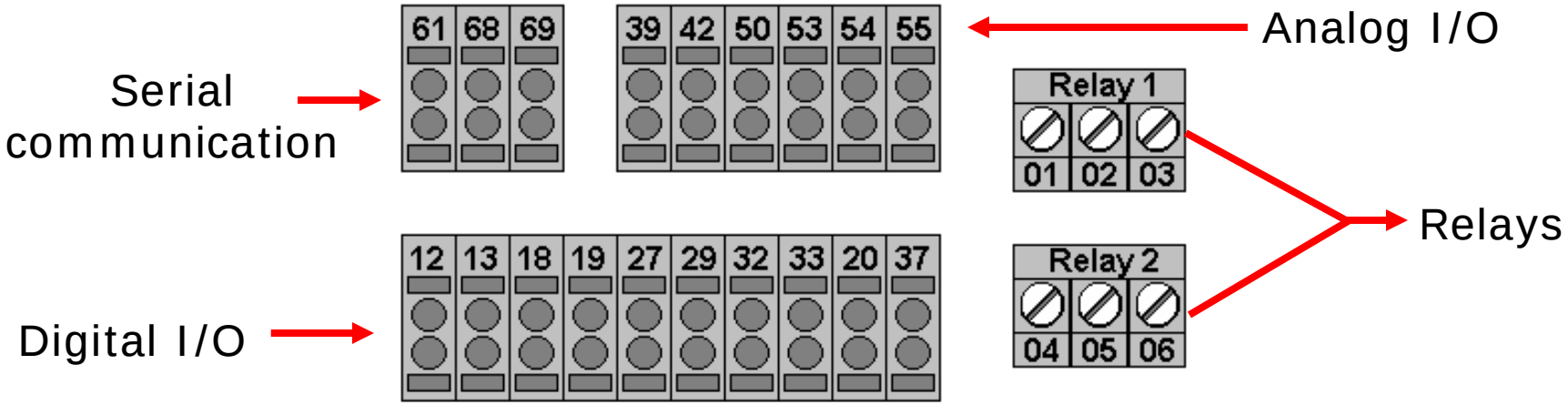
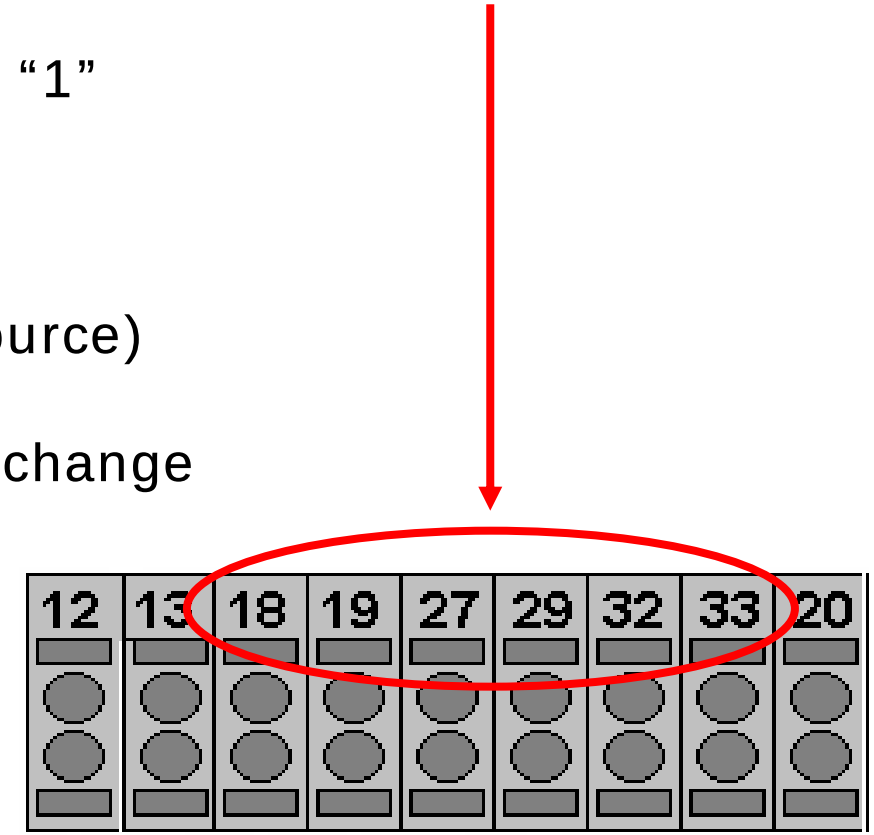
Control I/O Terminals

- Digital, analog, serial communication & relays
- Terminals 12 and 13 are +24 VDC supply – digital (I/O)
- Terminal 50 is + 10 VDC supply – analog (I/O)
- Terminals 20, 39 & 55 are common

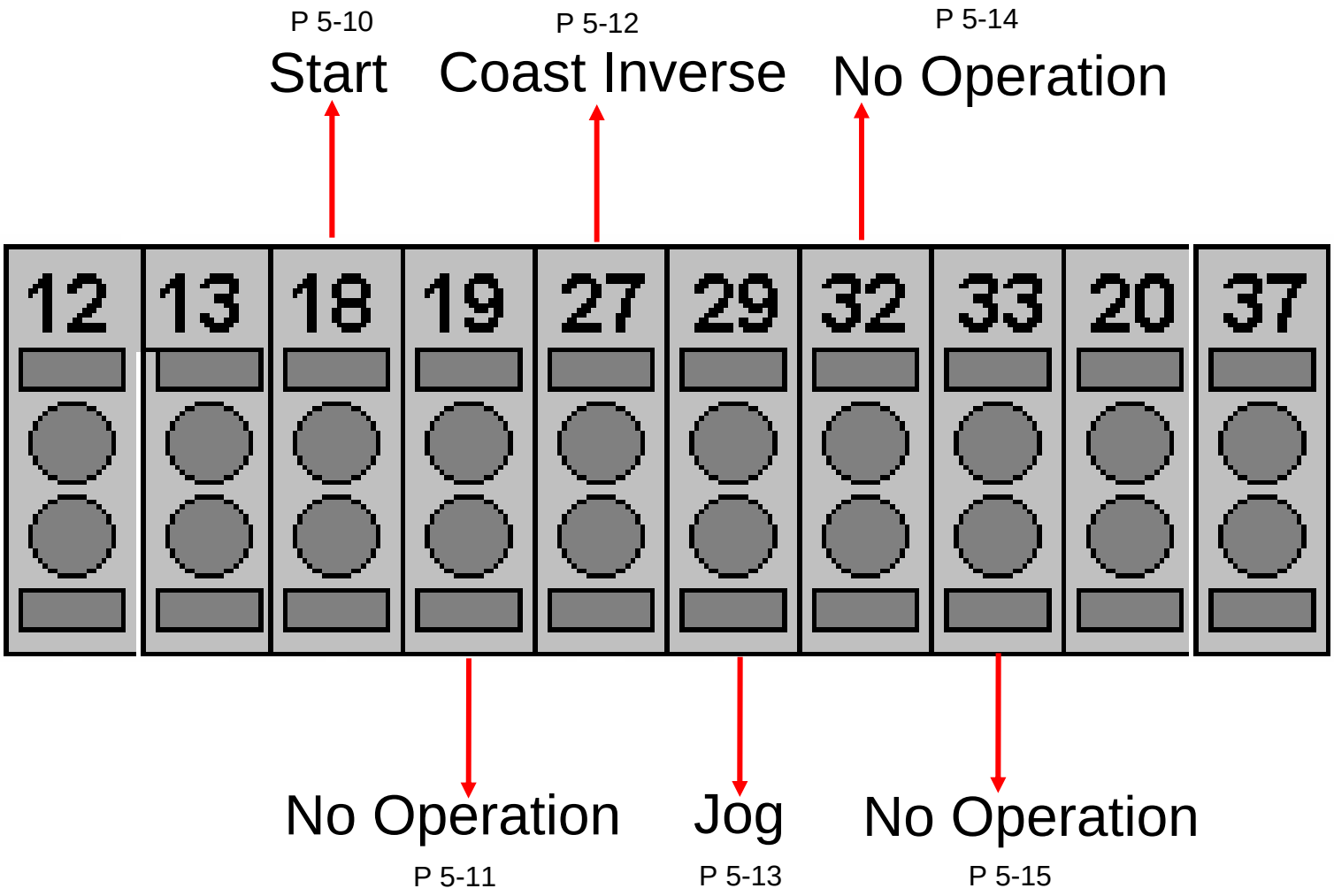


Digital Inputs

- 6 programmable inputs with 43 functions
- +10 – 24 VDC = Logic “1”
- <5 VDC = Logic “0”
- NPN or PNP (sink or source)
- Cycle power to accept change
- Isolated

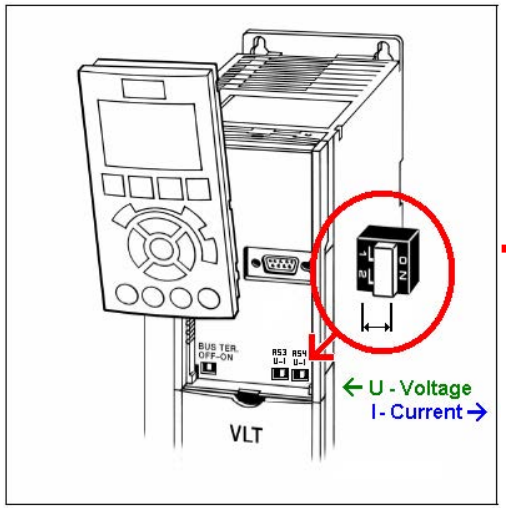


Digital Input Default Programming

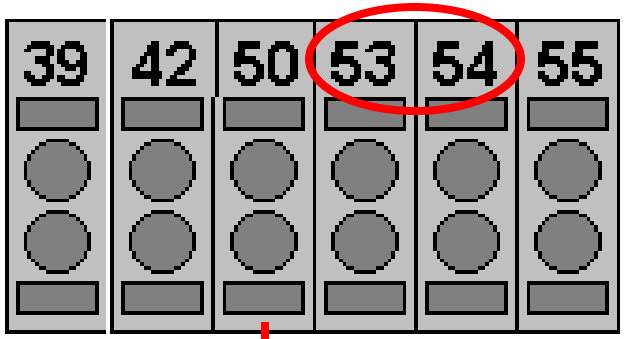


Analog Inputs

- 2 programmable inputs, terminals 53 and 54
- Scalable in software to match hardware
- Set for current or voltage (*default*)

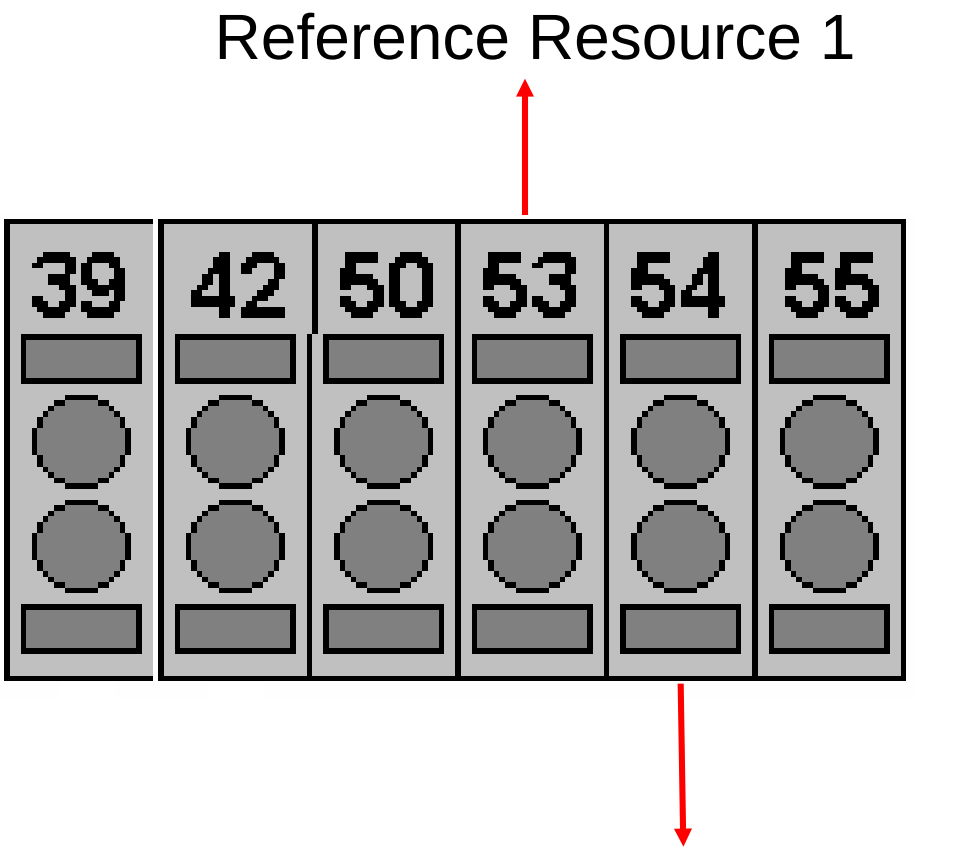


Dip switches



+10 VDC supply

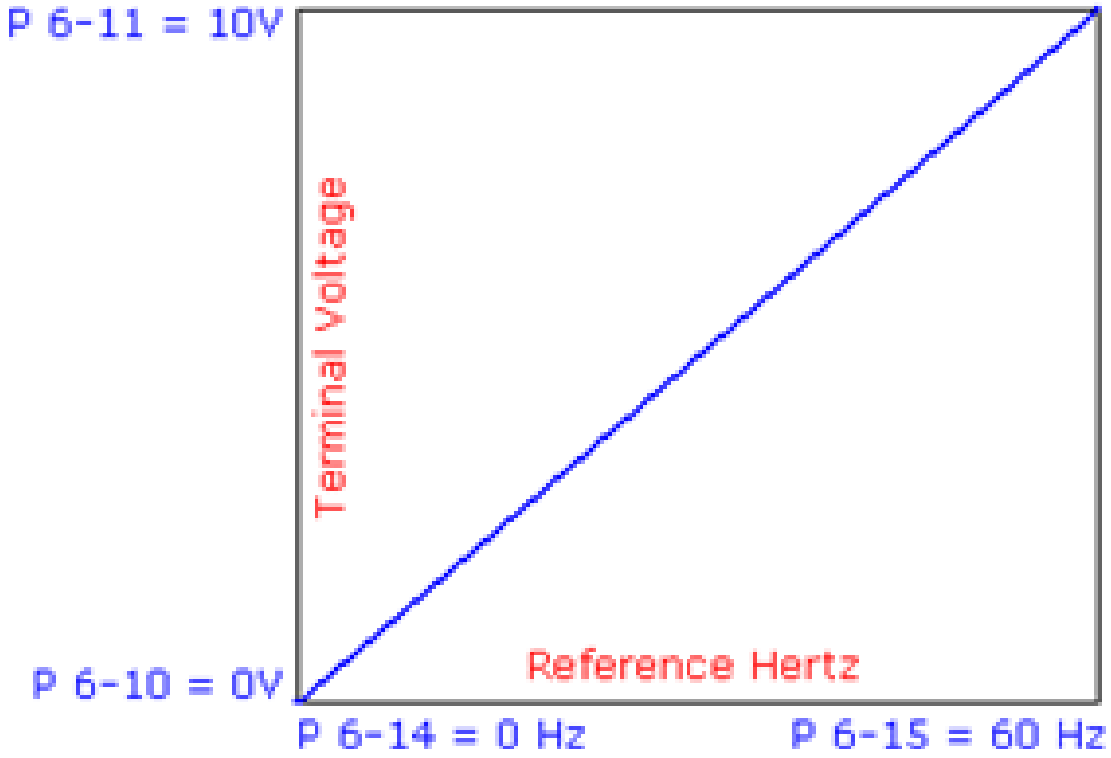
Analog Input Default Programming



Analog Input Scaling

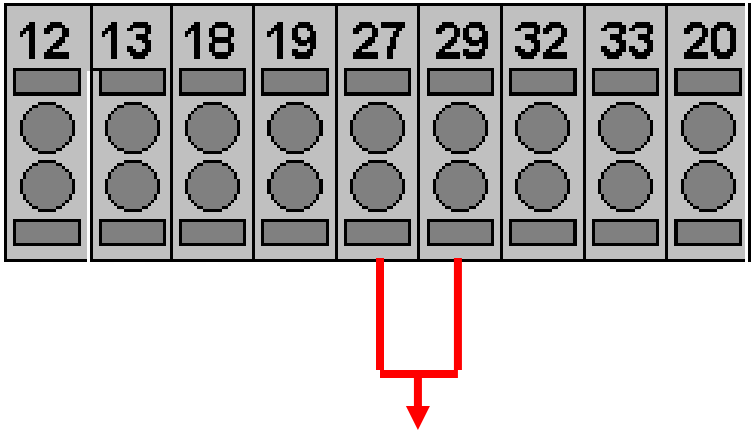
Function	Default	Range	AI53	AI54
Low voltage scaling	0.07 V	0.00 – 10.00 V	6-10	6-20
High voltage scaling	10.00 V	0.00 – 10.00 V	6-11	6-21
Low current scaling	4.0 mA	0.00 – 20.00 mA	6-12	6-22
High current scaling	20.00 mA	0.00 – 20.00 mA	6-13	6-23
Low reference or FB scaling	0.000	-999,999.999 to 999,999.999	6-14	6-24
High reference or FB scaling	100.000	-999,999.999 to 999,999.999	6-15	6-25
Filter time	0.001 s	0.001-10.000 s	6-16	6-26
Live zero	Enabled	Disabled or Enabled	6-17	6-27

Analog Input Scaling



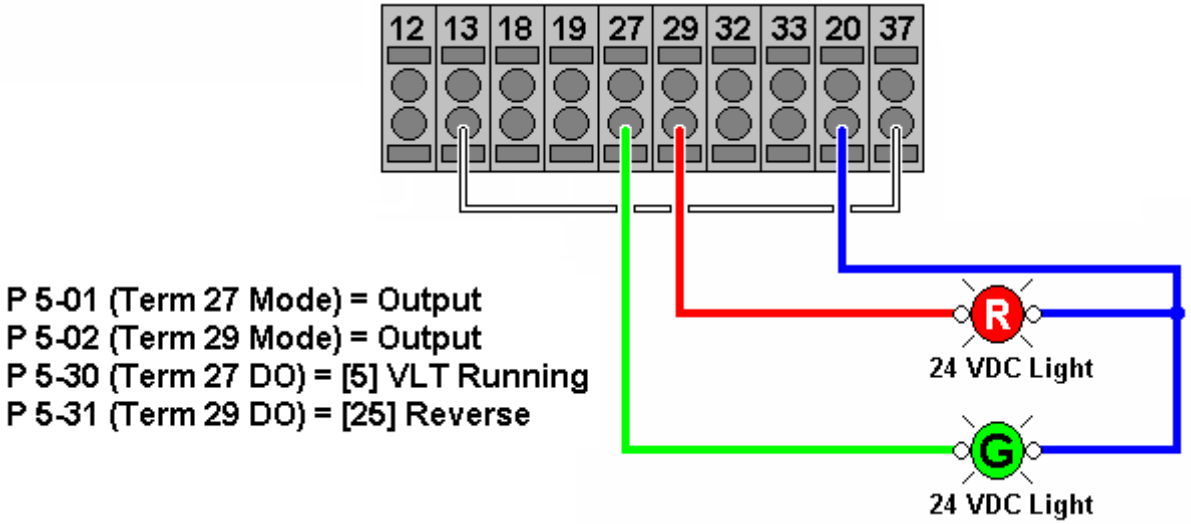
Digital Outputs

- Terminals 27 and 29 can be used as digital outputs
- Must be programmed to function as outputs
- 24 VDC output signal as PNP; 0 VDC output as NPN
- Can sink or source current (max. 40 mA)



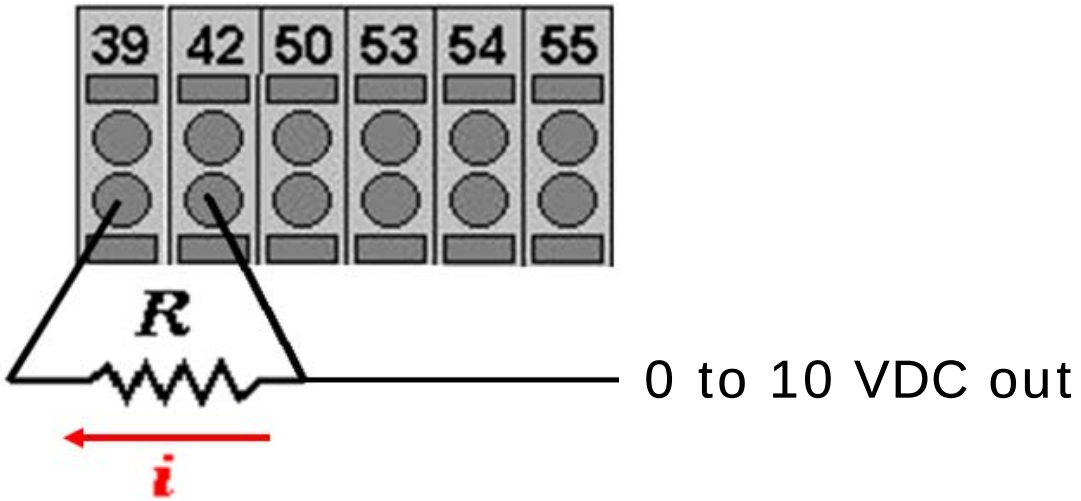
Digital Outputs

- Parameter 5-01 selects terminal 27 as DI or DO
- Parameter 5-02 selects terminal 29 as DI or DO
- Parameters 5-30 and 5-31 set function
- Digital outputs supply +24 VDC in PNP mode
- If P 5-00 is set to NPN, common side of the DOs must go to 12



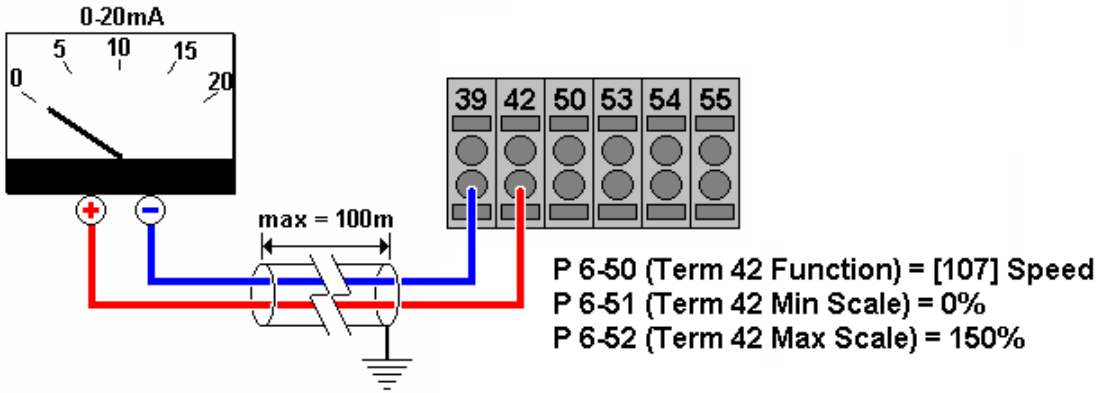
Analog Output

- Analog output current on terminal 42
- Common terminals 20, 39 and 55
- Can output ranges from 0/4 to 20 mA
- Can be converted from current to voltage
- Maximum device impedance is 500 Ohms



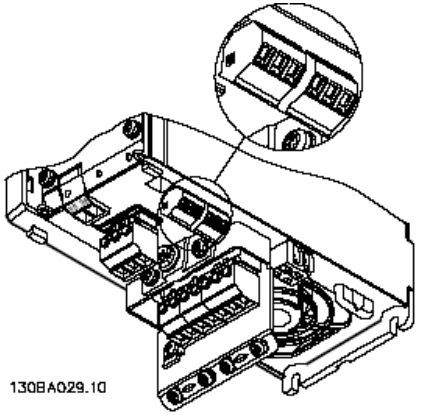
Analog Output

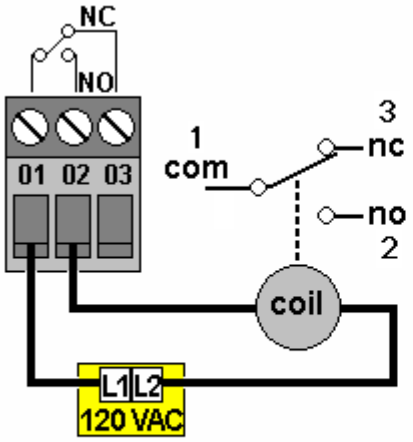
- Current output
- Meter indication
- Terminal 42 is only output used for the AO
- Function of terminal 42 is set in parameter 6-50
- Parameters 6-51 and 6-52 set the min. and max. output



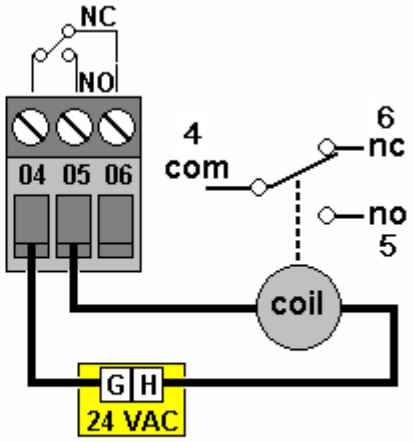
Auxiliary Relays

- Relay 1: terminals 01, 02, 03
- Relay 2: terminals 04, 05, 06 (FC 302 only)
- Max. load 240 VAC @ 2A (resistive load)





Relay Output
Dry Contacts



Relay Output
Dry Contacts

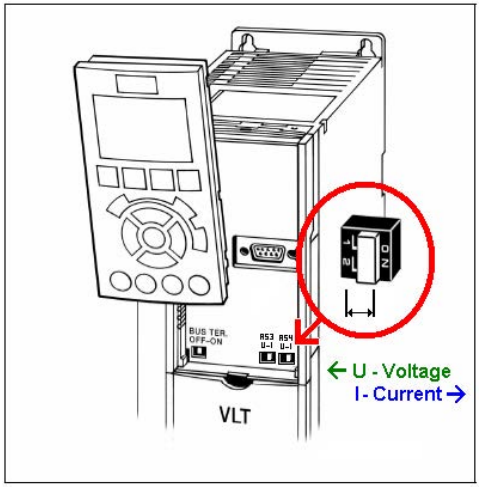
Par 5-40	**“Relay Function”**	**<9> “Alarm”**
Par 5-41	**“On Delay, Relay”**	**0.01 s**
Par 5-42	**“Off Delay, Relay”**	**2.00 s**

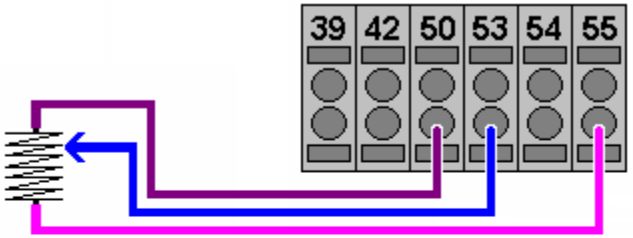
Control Schemes

- Wide variety of HVAC fan & pump applications
- Wide variety of control configurations
- Programmable I/O on all FC series drives
- Provides extreme flexibility & is easily adapted

Start Switch & Speed Pot for Reference

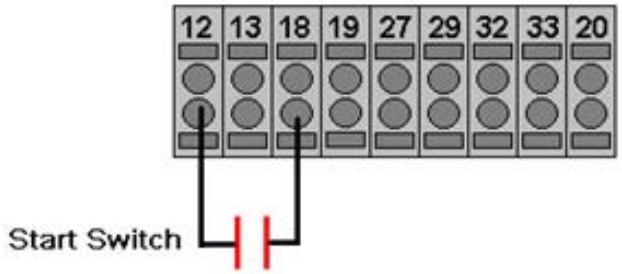
- 0 to 10 VDC signal on analog inputs
- 1K – 10K Potentiometer
- P 3-15 identifies the reference source #1
- P 6-10 and 6-11 set the voltage range
- P 6-14 and 6-15 set the speed range
- Read switch position in (16-61) for terminals 53 & (16-63) for 54.
- DI 18 set to “Start”





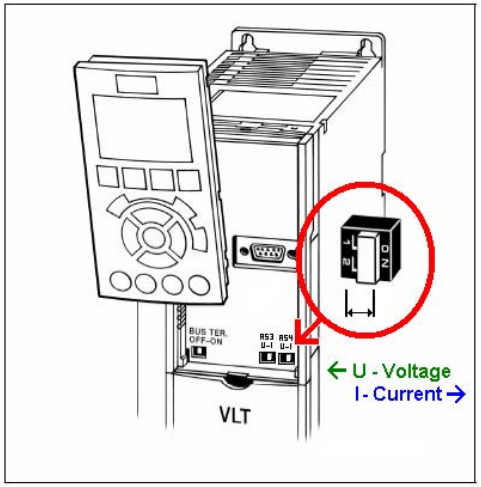
P 3-15 (Ref Resource 1) = AI 53

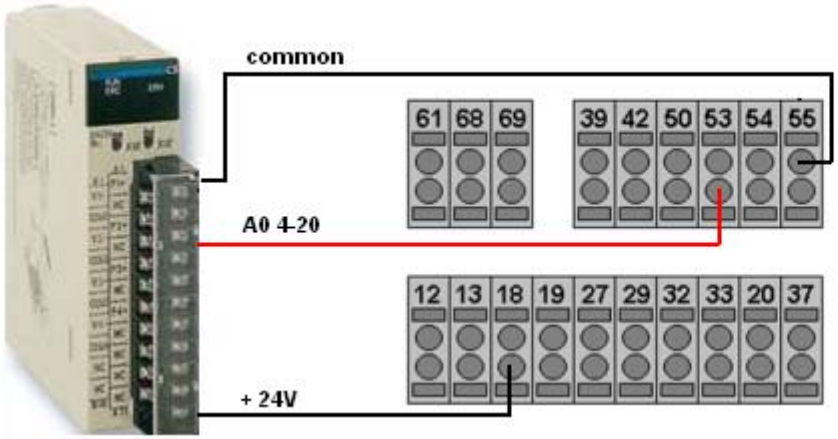
P 6-10 (AI 53 Low Voltage) = 0 Volts
P 6-11 (AI 53 Hi Voltage) = 10 Volts
P 6-14 (AI 53 Low Value) = 0 Hz
P 6-15 (AI 53 Hi Value) = 60 Hz



TRANE BMS Controlled Start / Stop & Reference

- 0 to 10 VDC signal on analog inputs
- 1K – 10K Potentiometer
- P 3-15 identifies the reference source #1
- P 6-10 and 6-11 set the voltage range
- P 6-14 and 6-15 set the speed range
- DI 18 set to “Start”
- AI 53 DIP set to Current

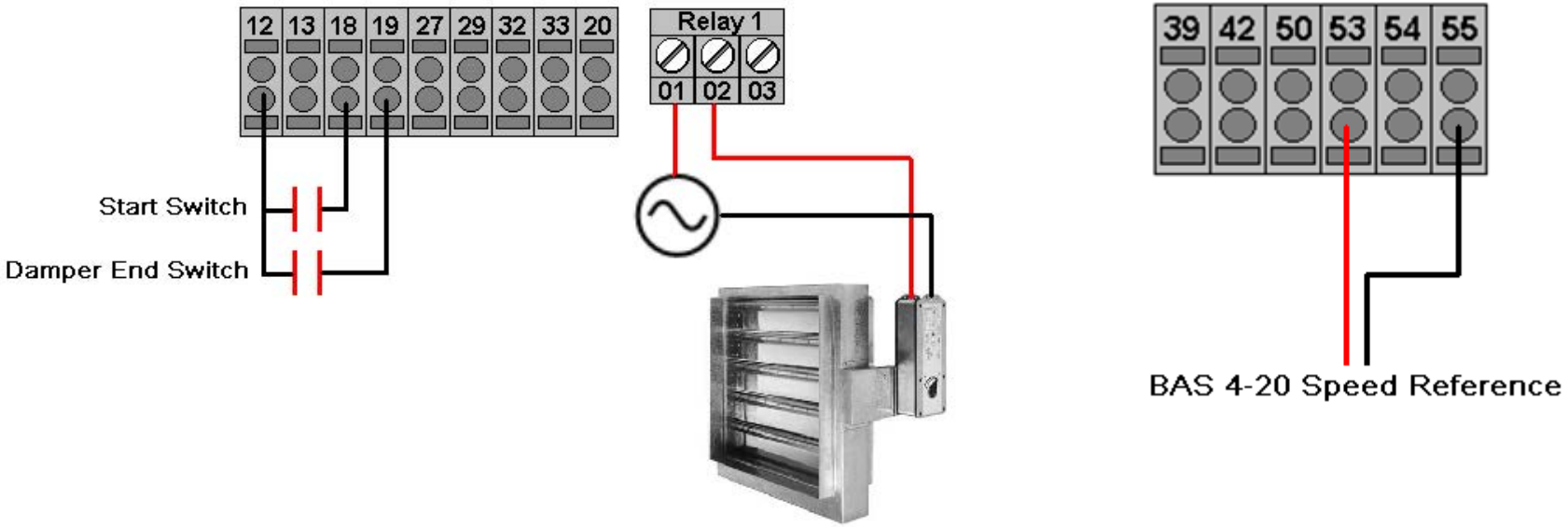




P 5-10 (DI 18) = Start
P 3-15 (Ref Resource 1) = AI 53
P 6-12 (AI 53 Low Current) = 4 mA
P 6-13 (AI 53 High Current) = 20 mA
P 6-14 (AI 53 Low Reference = 0 Hz
P 6-15 (AI 53 High Current = 60 Hz

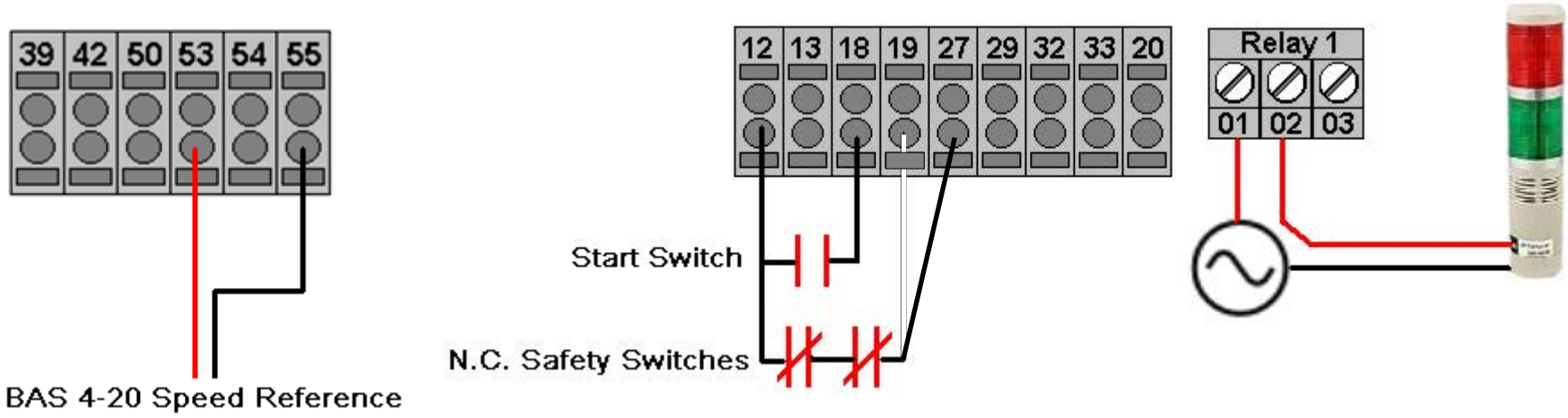
HVAC Run Permissive Circuit

- DI 18 is programmed for “Start”
- Relay #1 is programmed for “Start Command Active”
- DI 19 is programmed to “Run Permissive”
- BMS Reference signal on AI 53



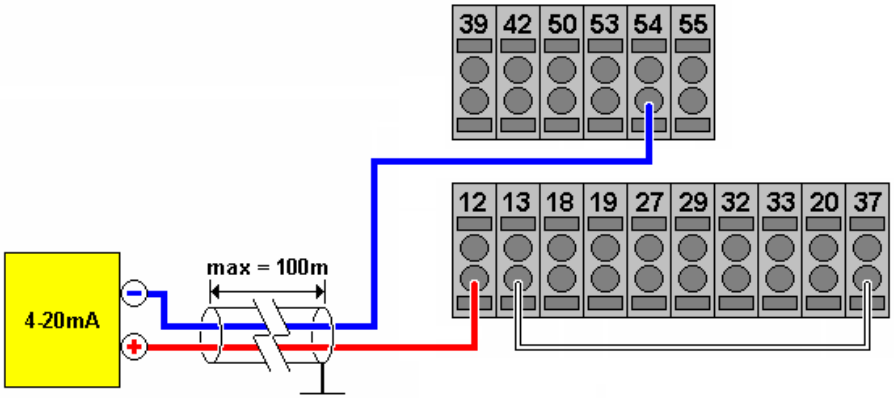
Safety Interlock Circuit

- DI Terminal 18 programmed for start
- DI Terminal 27 programmed for “External Interlock”
- 4-20 mA speed reference on AI 53
- Relay # 1 programmed for “Alarm”



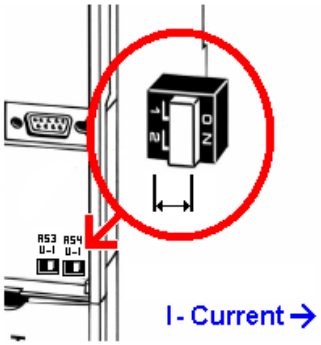
Closed Loop Setup with Feedback

- 2-wire 4-20 mA transmitter connected
- Terminal 12 or 13 supplies +24 VDC to transmitter
- Place appropriate AI switch to the right for current
- parameter 1-00 set to “Closed Loop”
- Internal set-point entered in software



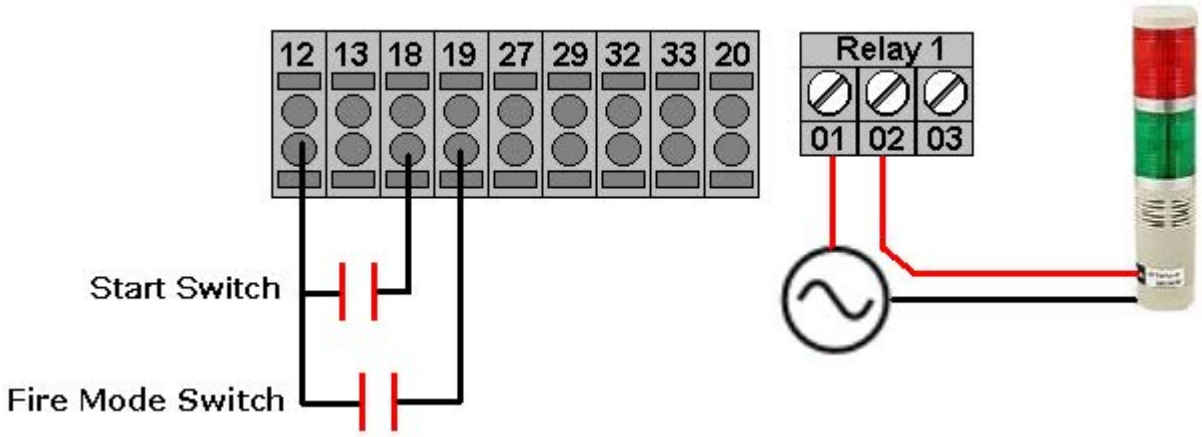
The following parameters will scale the feedback terminal (default is AI 54) to match the range of the connected transducer

6-22 = terminal 54 low current (e.g. 4mA)
6-23 = terminal 54 high current (e.g. 20 mA)
6-24 = terminal 54 low feedback value (e.g. 0 in H2O)
6-25 = terminal 54 high feedback value (e.g. 5 in H2O)



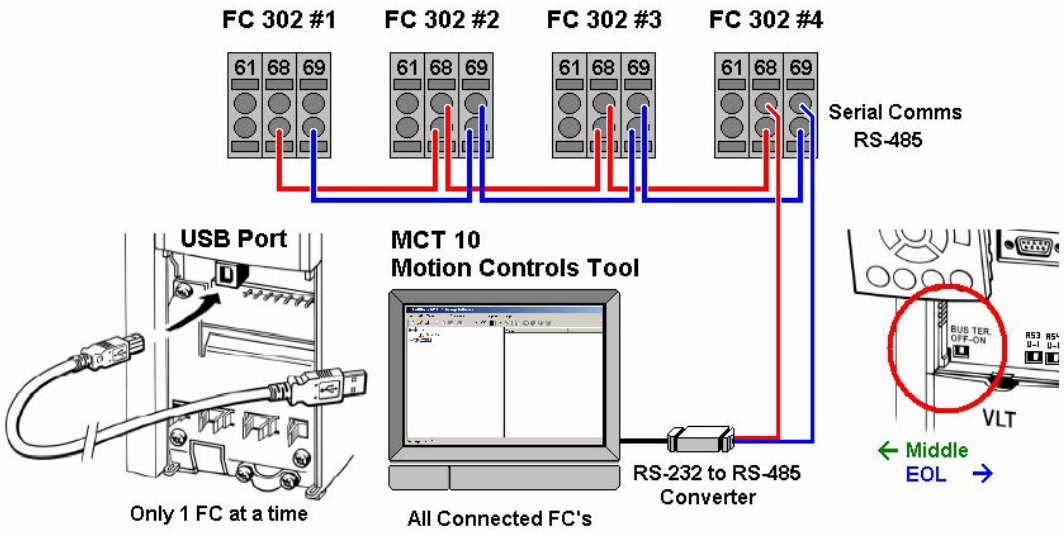
Fire Mode Configuration

- VFD can “Run to Death” if fire mode is activated
- DI Terminal 19 programmed for “Fire Mode”
- Parameters 24-00 – 24-09 set up fire mode operation
- Relay # 1 programmed for “Fire Mode was activated”



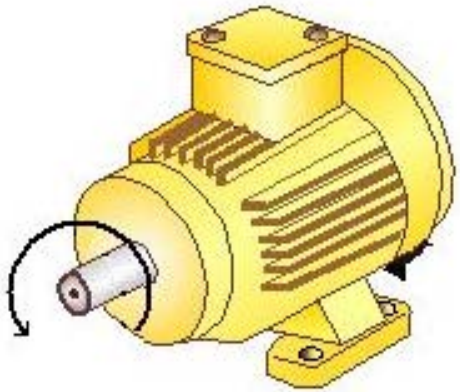
Serial Communication

- Control several VFD's with one pair of wires
- RS 485 positive to terminal 68; negative to 69
- Termination resistor set by switch
- Need repeater (amplifier) after 31 drives attached together
- USB port for communicating with one VFD at a time



Checking Rotation

- Be aware that motor could spin backwards
- Place jumpers for terminals 27
- Press “Hand On” and put in a **small** local reference value
- Observe motor rotation
- If incorrect, switch any 2 output leads (U, V, W)



This can also be accomplished by using parameter 1-28 found in the main menu or Q2

Verifying Operation

- **Place drive in “Hand Mode”**
  - —Check direction of motor rotation
  - —Ensure the drive operates over the entire speed range
  - —Check that ramp rates are correct (no warning or alarms)
  - —Verify that the motor is running smoothly

Place drive in “Auto On” mode

- —Verify that the drive is responding to the I/O
- —Run under full load and observe the displays

Final Adjustments

- Enable “Flying Start” in parameter 1-73
- Setup keypad lock in parameter group 0-6
- Program skip frequency bandwidths in parameter group 4-6 if necessary
- Copy all parameters to the LCP with parameter group 0-5

Review

1) Before applying power to a drive, it is recommended to:
   - A) disconnect motor from load
   - B) remove fuses
   - C) double-check all wiring, and ensure all run commands and speed commands are off or at zero
   - D) ground all outputs

2) At the moment that the power is switched on, the applied voltage at terminals L1, L2, & L3 should be:
   - A) less than 24 VAC, then increased slowly
   - B) equal to the voltage rating of the drive +/- 10%
   - C) at the maximum value
   - D) 110 VAC

Review

3) True or false? It is OK to put your hands inside a drive to work on it immediately after line power is turned off. Please explain.

4) What is the function of the “Cancel” key on the LCP?

Review

5) What results from hitting the “Info” key?

6) Where can the 14-parameter “Quick Setup” group be found?

Review

7) You want to change the motor voltage to 460. What needs to be done in software, starting from the main menu?

8) What does the “AMA” function do?

Review

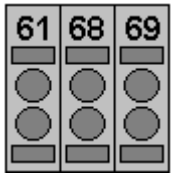
9) Match up the following terminal blocks:

Digital I/O

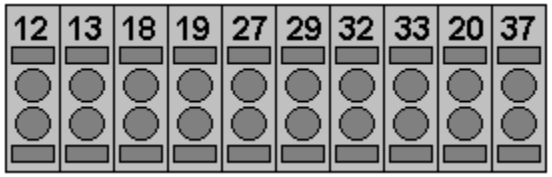
Analog I/O

Serial communications

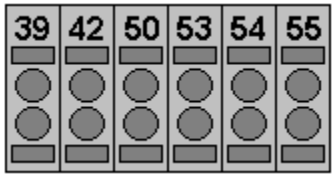
A



B



C



Review

10) Which terminal is programmed as a safety by default & must be dealt with in order for the drive to run? What are your options?

11) What does setting parameter 0-50 (LCP Copy) to the value “All TO LCP” do?

Review

12) Which terminal is used for the analog output?

13) In order for the drive to run the motor in the reverse direction, which of the following must be done?

A) Reverse two of the AC power leads going into the drive

B) Reverse the polarity of the reference signal

C) Set parameter 4-10 to “both directions”

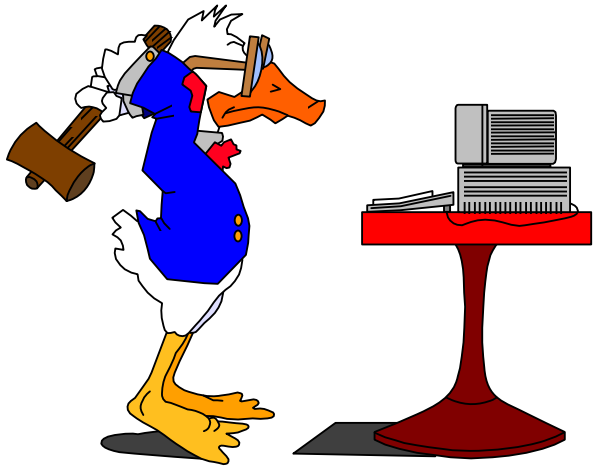
D) Set parameter 5-00 to NPN

TRANE®

Remember…

When all else fails,

Read The Manual!



MCU
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This concludes this training module. Please proceed to the next installation module, which covers applications in more detail.

If you have any comments or questions, please contact:

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Danfoss Drives

4401 N. Bell School Rd

Loves Park, Illinois 61111 USA

Phone: (800) 432-6367 or (815) 639-8600

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