



Series 37D

Encoderless Vector

Control

Installation & Operating Manual

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Section 1 Quick Start

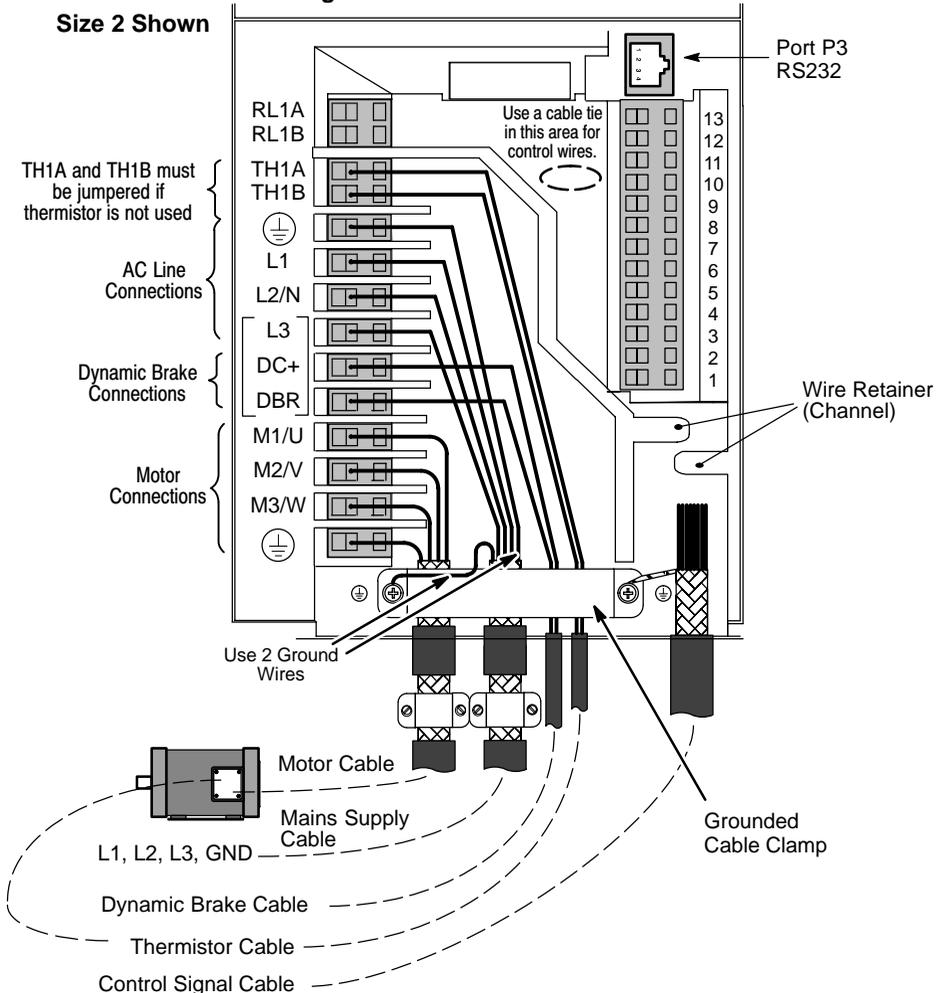
The basic steps for connection and setup are provided in this section. Detailed descriptions of each step and parameter settings are provided later in this manual. Be sure to comply with all applicable codes when installing this control.

Minimum Connection Requirements Refer to Section 3 for cover removal procedure.

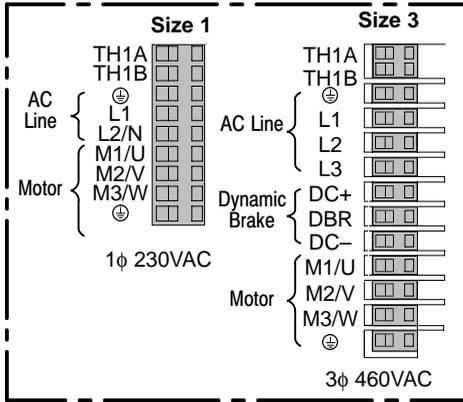
Size 1, 2, 3 Power and Motor Connections

Figure 1-1 shows the minimum connections required at the power connector.

Figure 1-1 Power Connections



**Figure 1-2 Power Connections Continued
Size 1 and 3 Terminal Strips**

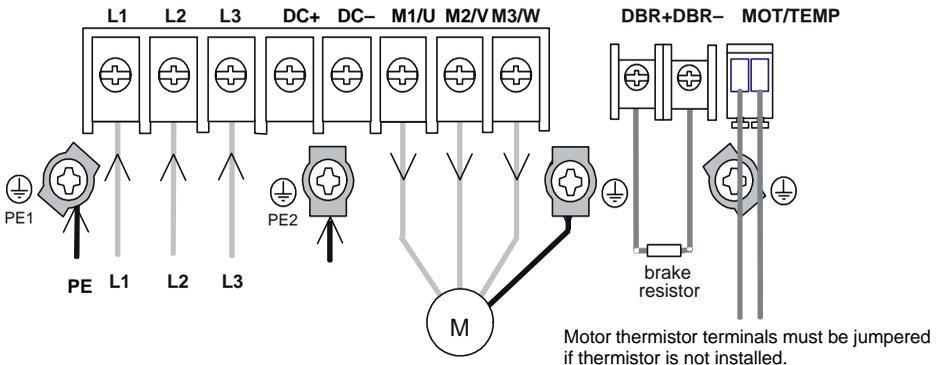


Size C Power and Motor Connections

Figure 1-3 shows the minimum connections required at the power connector. All cables must be shielded and the shields must be grounded at the knockout plate. The brake resistor and cable must be shielded if installed outside the enclosure.

1. Remove the terminal cover retaining screws and remove the terminal cover.
2. Lift the internal power terminal shield to allow connection of power and motor wires.
3. Feed the power supply and motor cables into the drive through the metal gland plate using the correct cable entries, and connect to the power terminals. Tighten power terminals to a torque of 12 lb-in (1.3Nm) – 5.5kW model, 16 lb-in (1.8Nm) – 7.5–11kW models; and earth terminals to 28 lb-in (3Nm). Tighten brake terminals to 12 lb-in (1.3Nm). Tighten thermistor terminals to 7 in-lb (0.8Nm).
4. Lower the internal power terminal shield.

Figure 1-3 Power Connections

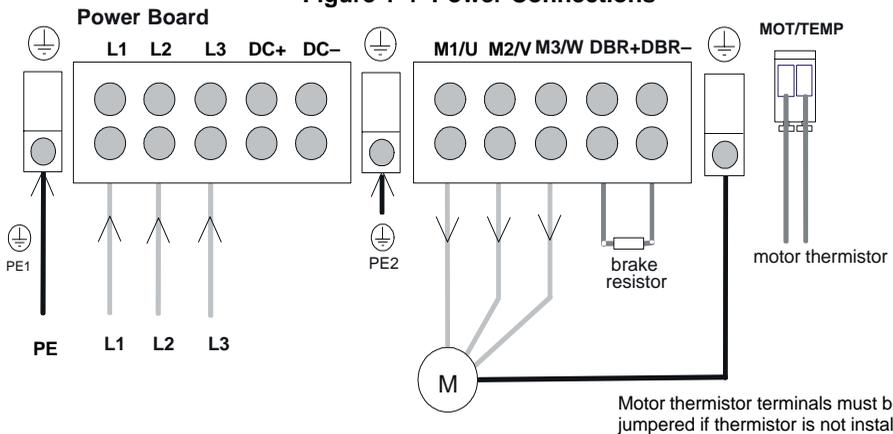


Size D Power and Motor Connections

Figure 1-4 shows the minimum connections required at the power connector. All cables must be shielded and the shields must be grounded at the knockout plate. The brake resistor and cable must be shielded if installed outside the enclosure.

1. Remove the terminal cover retaining screws and remove the terminal cover.
2. Lift the internal power terminal shield to allow connection of power and motor wires.
3. Feed the power supply and motor cables into the drive through the metal gland plate using the correct cable entries, and connect to the power terminals. Tighten the large terminals to a torque of 35 lb-in (4.0Nm), and earth terminals to 44 lb-in (5.0Nm). Tighten thermistor terminals to 7 in-lb (0.8Nm).
4. Lower the internal power terminal shield.

Figure 1-4 Power Connections

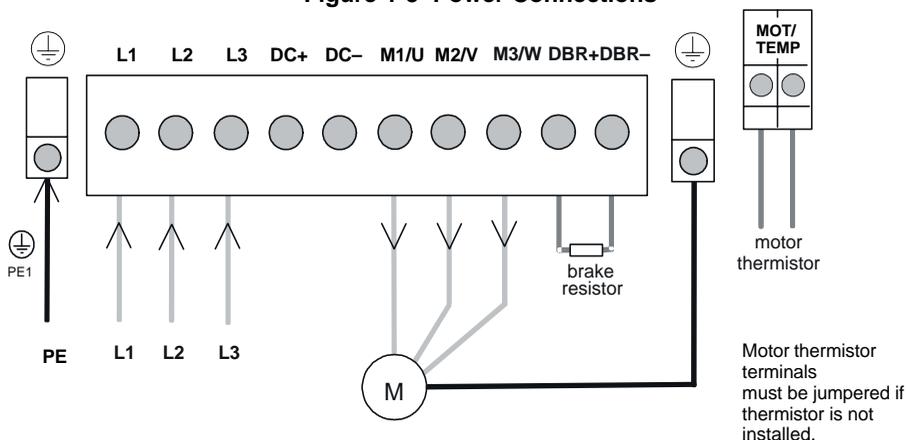


Size E Power and Motor Connections

Figure 1-5 shows the minimum connections required at the power connector. All cables must be shielded and the shields must be grounded at the knockout plate. The brake resistor and cable must be shielded if installed outside the enclosure.

1. Remove the terminal cover retaining screws and remove the terminal cover.
3. Feed the power supply and motor cables into the drive through the metal gland plate using the correct cable entries, and connect to the power terminals. Tighten the large terminals and earth terminals to 70 lb-in (8.0Nm). Tighten thermistor terminals to 7 in-lb (0.8Nm).
4. Lower the internal power terminal shield.

Figure 1-5 Power Connections

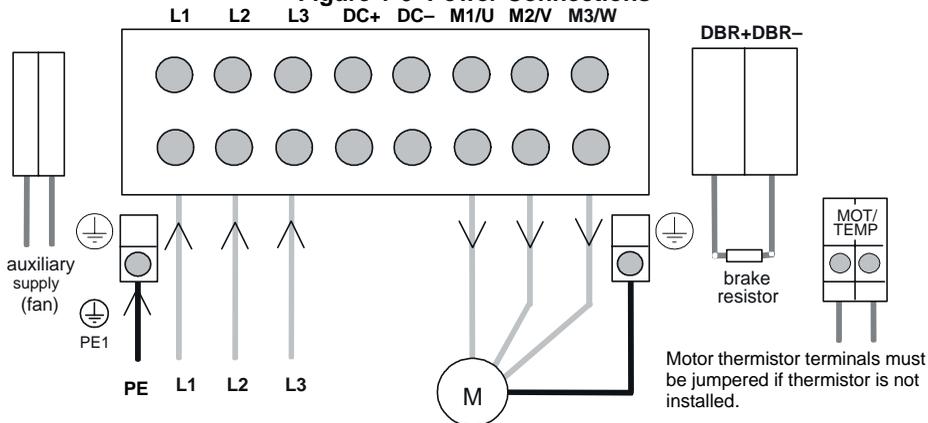


Size F Power and Motor Connections

Figure 1-6 shows the minimum connections required at the power connector. All cables must be shielded and the shields must be grounded at the knockout plate. The brake resistor and cable must be shielded if installed outside the enclosure.

1. Remove the terminal cover retaining screws and remove the terminal cover.
3. Feed the power supply and motor cables into the drive through the metal gland plate using the correct cable entries, and connect to the power terminals. Tighten the large terminals to a torque of 177 lb-in (20.0Nm), and earth terminals to 50 lb-in (6.0Nm). Tighten brake resistor terminals to 16 in-lb (1.8Nm). Tighten thermistor and fan terminals to 6 in-lb (0.7Nm).
4. Lower the internal power terminal shield.

Figure 1-6 Power Connections

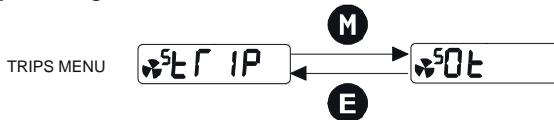


Thermistor Connections (connections are shown in Figures 1-3 to 1-6).

This input is provided for over-temperature detection for motors that have an internal thermistor. There is no polarity to the thermistor connections. This provides “Basic” insulation only to the SELV control circuits and assumes the motor has “Basic” insulation to the windings/mains circuits. The thermistor type supported is PTC ‘Type A’ as defined in IEC 34–11 Part 2. The resistance thresholds are:

Rising temperature trip resistance: 1650 to 4000 ohms
 Falling temperature trip reset resistance 750 to 1650 ohms

If the motor does not have an internal thermistor, you should disable the thermistor trip function either by setting Invert Thermistor Input (S Ot) to 1, or by shorting the thermistor terminals TH1A and TH1B.

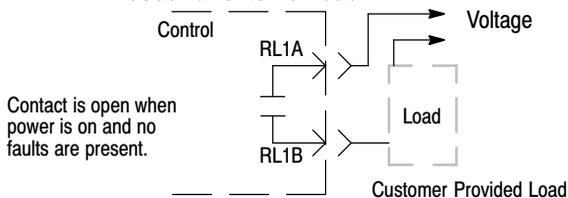


External Brake Resistor

For Size 2 and 3 controls, connect the dynamic brake resistor between terminals DC+ and DBR as shown in Figure 3-7.

For Size C to F controls, connect the dynamic brake resistor between terminals DBR+ and DBR– as shown in Figures 1-3 to 1-6.

User Relay A customer provided, external DC or AC power source must be used for external load.



Note: Contact rated 250V @4A resistive (non-inductive).

Signal Connections

1. With the cover removed, connect the analog and digital inputs and outputs as shown in Figure 1-2.
The signals are described in Table 1–1.
2. Install the front cover.

Table 1–1 Analog/Digital Signal Descriptions

Terminal (SELV)	Signal Name	Description	Range
P3		RS232 port for use with remote mounted keypad.	
RL1A	User Relay	Volt-free contact - 4A maximum, non-inductive	0-250VAC/24VDC
RL1B	User Relay	Volt-free contact - 4A maximum, non-inductive	0-250VAC/24VDC
13	DIN7 (ENC B)	Configurable digital input or digital output. See Operating Modes 0-8 for function definition. For Encoder Follower mode, used as the Encoder B channel signal input.	
12	DIN6 (ENC A)	Configurable digital input or digital output. See Operating Modes 0-8 for function definition. For Encoder Follower mode, used as the Encoder A channel signal input.	
11	DIN5	Configurable digital input or digital output. See Operating Modes 0-8 for function definition.	
10	DIN4/ DOUT2	Configurable digital input or digital output (output is source, open collector, 20mA maximum). See Operating Modes 0-8 for function definition.	0-24V source open collector 20mA max
9	DIN3/ DOUT1	Configurable digital input or digital output (output is source, open collector, 20mA maximum). See Operating Modes 0-8 for function definition.	0-24V source open collector 20mA maximum
8	DIN2	Digital Input 2.	0-24V
7	DIN1	Digital Input 1.	0-24V
6	+24V	24V - 24V supply for digital I/O	50mA max
5	AOUT1	Analog Output - 10mA maximum	0-10V
4	10VREF	10V reference (10mA maximum loading)	10V
3	AIN2	Analog Input 2	0-10V, 4-20mA
2	AIN1	Analog Input 1 - Setpoint. If unused, connect to 0VDC.	0-10V
1	0V	0V - Reference for Analog/Digital I/O For single control installations, connect pin 1 (0V) to PE. For multiple control installations, connect the 0V terminals of each control together. Then connect only one control to PE.	0V

Section 2

General Information

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This manual is copyrighted and all rights are reserved. This document may not, in whole or in part, be copied or reproduced in any form without the prior written consent of Baldor.

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Microsoft and MS-DOS are registered trademarks, and Windows is a trademark of Microsoft Corporation. UL and cUL are registered trademarks of Underwriters Laboratories.

CE Compliance A custom unit may be required, contact Baldor. Compliance to Directive 89/336/EEC is the responsibility of the system integrator. A control, motor and all system components must have proper shielding, grounding, and filtering as described in MN1383. Please refer to MN1383 for installation techniques for CE compliance. For additional information, refer to Section 3 and Appendix B of this manual.

Limited Warranty

For a period of one (1) year from the date of original purchase, BALDOR will repair or replace without charge controls and accessories which our examination proves to be defective in material or workmanship. This warranty is valid if the unit has not been tampered with by unauthorized persons, misused, abused, or improperly installed and has been used in accordance with the instructions and/or ratings supplied. This warranty is in lieu of any other warranty or guarantee expressed or implied. BALDOR shall not be held responsible for any expense (including installation and removal), inconvenience, or consequential damage, including injury to any person or property caused by items of our manufacture or sale. (Some states do not allow exclusion or limitation of incidental or consequential damages, so the above exclusion may not apply.) In any event, BALDOR's total liability, under all circumstances, shall not exceed the full purchase price of the control. Claims for purchase price refunds, repairs, or replacements must be referred to BALDOR with all pertinent data as to the defect, the date purchased, the task performed by the control, and the problem encountered. No liability is assumed for expendable items such as fuses.

Goods may be returned only with written notification including a BALDOR Return Authorization Number and any return shipments must be prepaid.

Product Notice Intended use:

These drives are intended for use in stationary ground based applications in industrial power installations according to the standards EN60204 and VDE0160. They are designed for machine applications that require variable speed controlled three phase AC induction motors.

These drives are not intended for use in applications such as:

- Home appliances
- Mobile vehicles
- Ships
- Airplanes

Unless otherwise specified, this drive is intended for installation in a suitable enclosure. The enclosure must protect the control from exposure to excessive or corrosive moisture, dust and dirt or abnormal ambient temperatures.

Safety Notice: This equipment contains high voltages. Electrical shock can cause serious or fatal injury. Only qualified personnel should attempt the start-up procedure or troubleshoot this equipment.

This equipment may be connected to other machines that have rotating parts or parts that are driven by this equipment. Improper use can cause serious or fatal injury. Only qualified personnel should attempt the start-up procedure or troubleshoot this equipment.

- System documentation must be available at all times.
- Keep non-qualified personnel at a safe distance from this equipment.
- Only qualified personnel familiar with the safe installation, operation and maintenance of this device should attempt start-up or operating procedures.
- Always remove power before making or removing any connections to this control.

PRECAUTIONS: Classifications of cautionary statements.

 **WARNING:** Indicates a potentially hazardous situation which, if not avoided, could result in injury or death.

 **Caution:** Indicates a potentially hazardous situation which, if not avoided, could result in damage to property.

Continued on next page.

-
- ⚠ WARNING:** Do not touch any circuit board, power device or electrical connection before you first ensure that power has been disconnected and there is no high voltage present from this equipment or other equipment to which it is connected. Electrical shock can cause serious or fatal injury.
 - ⚠ WARNING:** Be sure that you are completely familiar with the safe operation of this equipment. This equipment may be connected to other machines that have rotating parts or parts that are controlled by this equipment. Improper use can cause serious or fatal injury.
 - ⚠ WARNING:** Be sure all wiring complies with the National Electrical Code and all regional and local codes or CE Compliance. Improper wiring may cause a hazardous condition.
 - ⚠ WARNING:** Be sure the system is properly grounded before applying power. Do not apply AC power before you ensure that grounds are connected. Electrical shock can cause serious or fatal injury.
 - ⚠ WARNING:** Do not remove cover for at least five (5) minutes after AC power is disconnected to allow capacitors to discharge. Electrical shock can cause serious or fatal injury.
 - ⚠ WARNING:** Improper operation may cause violent motion of the motor and driven equipment. Be certain that unexpected movement will not cause injury to personnel or damage to equipment.
 - ⚠ WARNING:** Motor circuit may have high voltage present whenever AC power is applied, even when motor is not moving. Electrical shock can cause serious or fatal injury.
 - ⚠ WARNING:** If a motor is driven mechanically, it may generate hazardous voltages that are conducted to its power input terminals. The enclosure must be grounded to prevent a possible shock hazard.
 - ⚠ WARNING:** The user must provide an external hard-wired emergency stop circuit to disable the control in the event of an emergency.

Continued on next page.

⚠ Caution: To prevent equipment damage, be certain that the input power has correctly sized protective devices installed as well as a power disconnect.

⚠ Caution: Avoid locating the control immediately above or beside heat generating equipment, or directly below water or steam pipes.

⚠ Caution: Avoid locating the control in the vicinity of corrosive substances or vapors, metal particles and dust.

⚠ Caution: Suitable for use on a circuit capable of delivering not more than the RMS symmetrical short circuit amperes listed here at rated voltage.

<u>Horsepower</u>	<u>RMS Symmetrical Amperes</u>
1.5–50	5,000
51–200	10,000
201–400	18,000
401–600	30,000
601–900	42,000

⚠ Caution: Baldor recommends not using “Grounded Leg Delta” transformer power leads that may create ground loops and degrade system performance. Instead, we recommend using a four wire Wye.

⚠ Caution: Logic signals are interruptible signals; these signals are removed when power is removed from the drive.

⚠ Caution: The safe integration of the driver into a machine system is the responsibility of the machine designer. Be sure to comply with the local safety requirements at the place where the machine is to be used.

⚠ Caution: Controls must be installed inside an electrical cabinet that provides environmental control and protection. Installation information for the drive is provided in this manual. Motors and controlling devices that connect to the driver should have specifications compatible to the drive.

⚠ Caution: Do not tin (solder) exposed wires. Solder contracts over time and may cause loose connections.

⚠ Caution: Electrical components can be damaged by static electricity. Use ESD (electro-static discharge) procedures when handling this control.

Section 3

Receiving and Installation

Receiving & Inspection

Baldor Controls are thoroughly tested at the factory and carefully packaged for shipment. When you receive your control, there are several things you should do immediately.

1. Observe the condition of the shipping container and report any damage immediately to the commercial carrier that delivered your control.
2. Remove the control from the shipping container and remove all packing materials. The container and packing materials may be retained for future shipment.
3. Verify that the part number of the control you received is the same as the part number listed on your purchase order.
4. Inspect the control for external physical damage that may have been sustained during shipment and report any damage immediately to the commercial carrier that delivered your control.
5. If the control is to be stored for several weeks before use, be sure that it is stored in a location that conforms to published storage humidity and temperature specifications stated in this manual.

Location and Mounting

The location of the control is important. Installation should be in an area that is protected from direct sunlight, corrosives, harmful gases or liquids, dust, metallic particles, and vibration. Exposure to these can reduce the operating life and degrade performance of the control.

Several other factors should be carefully evaluated when selecting a location for installation:

To maintain compliance with European Electrical Safety Standard VDE0160(1994)/EN50178 (1998) the control must be mounted inside an enclosure that requires a tool for opening. The enclosure should provide 15dB attenuation to radiated emissions between 30–100MHz.

Mount the drive vertically on a solid, flat, non-flammable, vertical surface. It can be panel-mounted, or Size 1, 2, and 3 controls can be rail-mounted on a rail complying with EN50022 (35mm DIN). For DIN mount, hang the unit on the top DIN rail and push the unit onto the bottom DIN rail until it snaps in to position. Secure with a screw in the lower hole. See Dimensions in Section 6 of this manual.

1. For effective cooling and maintenance, the control should be mounted vertically on a smooth non-flammable surface.
2. At least 4.0 inches (100mm) top and bottom clearance must be provided for air flow. At least 0.4 inches (10mm) clearance is required between controls (each side). Size 1–3 have zero horizontal clearance.
3. **Operating Altitude derating.** Up to 3300 feet (1000 meters) no derating required. Derate the continuous and peak output current by 1% for each 330 feet (100 meters) above 3300 feet. Maximum operating altitude 16,500 feet (5,000 meters).
4. **Operating Temperature derating.** 0°C to 40°C ambient. Linear derating to 50°C maximum ambient.

Table 3-1 Watts Loss Ratings

Catalog No.	Output Current (A)	Watts Loss (W)	Catalog No.	Output Current (A)	Watts Loss (W)
ZD37D8A1F5-COD	1.5	26	ZD37D4A1F5-CRD	1.5	26
ZD37D8A2F2-COD	2.2	32	ZD37D4A02-CRD	2.0	32
ZD37D8A03-COD	3.0	41	ZD37D4A2F5-CRD	2.5	40
ZD37D8A04-COD	4.0	52	ZD37D4A4F5-CRD	4.5	61
ZD37D8A07-COD	7.0	82	ZD37D4A5F5-CRD	5.5	70
ZD37D2A10-CRD	10.5	3	ZD37D4A09-CRD	9.0	100
ZD37D2A16-CRD	16.5	3	ZD37D4A12-CRD	12	126
ZD37D2A22-ERD	22	330	ZD37D4A16-CRD	16	180
ZD37D2A28-ERD	28	350	ZD37D4A23-ERD	23	330
ZD37D2A42-ERD	42	640	ZD37D4A27-ERD	27	450
ZD37D2A54-ERD	54	740	ZD37D4A31-ERD	31	480
ZD37D2A68-ERD	68	920	ZD37D4A38-ERD	38	605
ZD37D2A80-ERD	80	920	ZD37D4A45-ERD	45	730
ZD37D2A104-CRD1	104	1100	ZD37D4A52-ERD	52	810
ZD37D2A130-CRD1	130	1450	ZD37D4A59-ERD	59	863
ZD37D2A154-CRD1	154	1650	ZD37D4A73-ERD	73	1052
			ZD37D4A87-ERD	87	1252
			ZD37D4A105-CRD1	105	1220
			ZD37D4A125-CRD1	125	1500
			ZD37D4A156-CRD1	156	1780
			ZD37D4A180-CRD1	180	2180

Optional Remote Keypad Installation

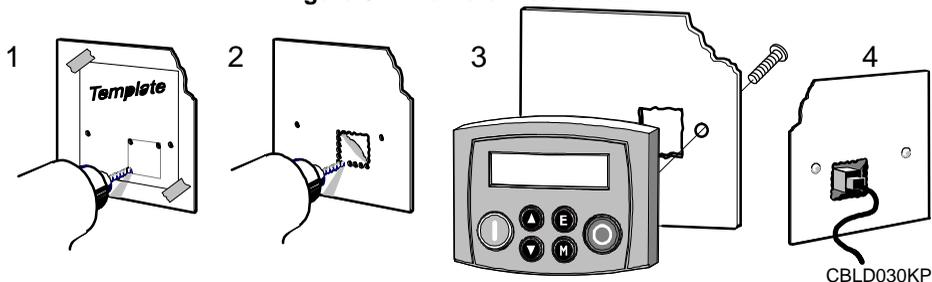
Size 1, 2, and 3

(Enclosure rating of IP54 when correctly mounted) . The keypad may be remotely mounted using optional Baldor keypad extension cable. Cable CBLD030KP is also required.

Tools Required:

- Center punch, file and screwdrivers (Phillips and straight) and crescent wrench.
- #19 drill and drill motor.

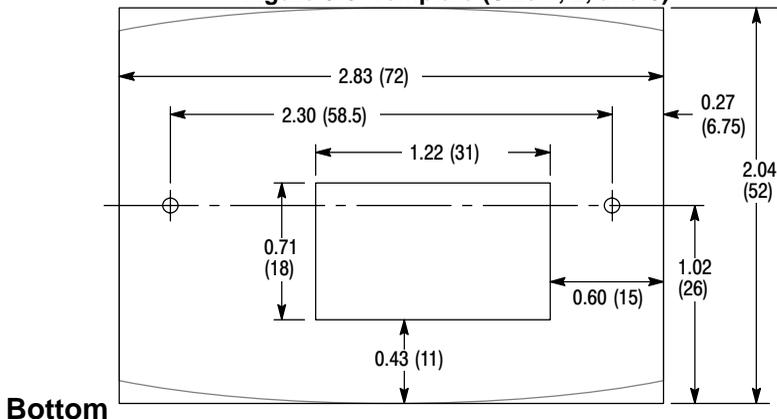
Figure 3-7 Remote Installation



Mounting Instruction: For tapped mounting holes

1. Locate a flat mounting surface. Place the template on the mounting surface or mark the holes as shown (1).
2. Accurately center punch the mounting holes.
3. Drill holes for the two mounting screws (2).
4. Use the drill to remove metal for the 18 x 31 mm rectangular hole (2).
5. Deburr the hole making sure the panel stays clean and flat.
6. Assemble the keypad to the panel (3). Use two screws provided.
7. Connect the 10 ft. cable at the keypad and P3 of the control (4).

Figure 3-8 Template (Size 1, 2, and 3)



Optional Remote Keypad Installation Continued

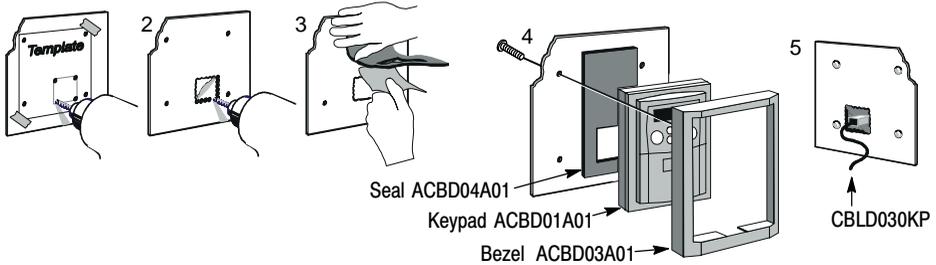
Size C, D, E and F

(Enclosure rating of IP54 when correctly mounted). The keypad may be remotely mounted using optional Baldor keypad extension cable. Keypad assembly ACBD02A01 includes Bezel, 10ft (3m) cable, screws and gasket required to mount it to an enclosure. Cable CBLD030KP is also required.

Tools Required:

- Center punch, file, screwdrivers and crescent wrench.
- #19 drill and drill motor.

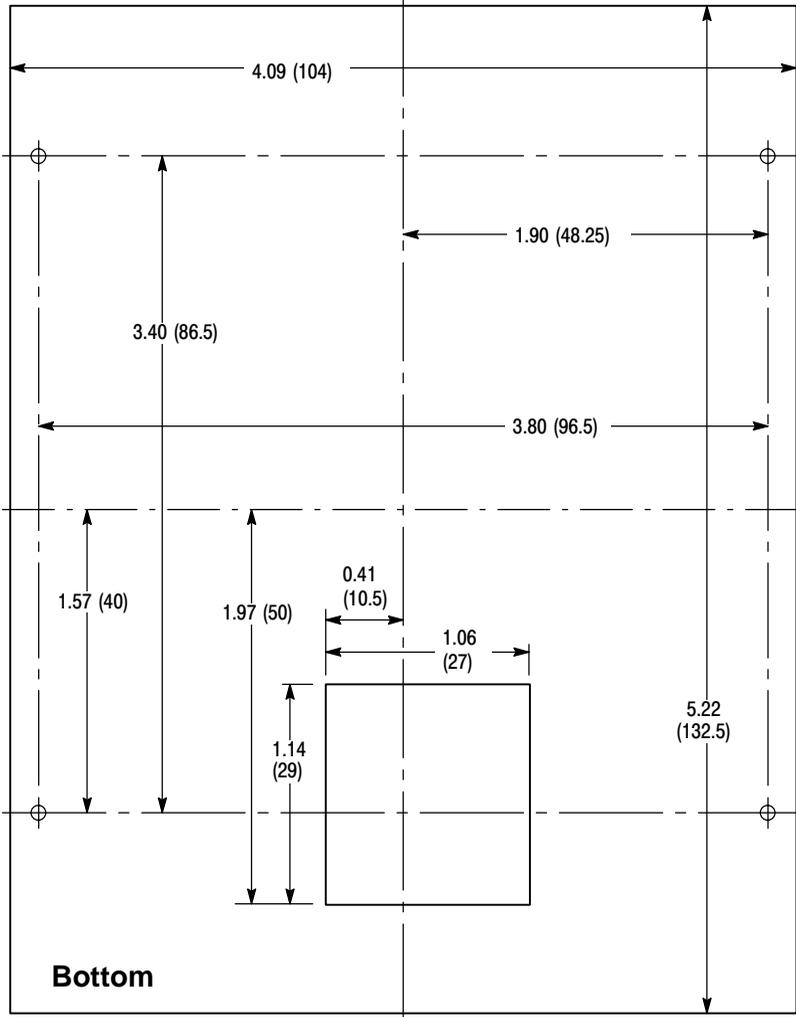
Figure 3-1 Remote Installation



Mounting Instruction: For tapped mounting holes

1. Locate a flat mounting surface. Place the template on the mounting surface or mark the holes as shown (1).
2. Accurately center punch the mounting holes.
3. Drill holes for the two mounting screws (2).
4. Use the drill to remove metal for the 18 x 31 mm rectangular hole (2).
5. Deburr the hole making sure the panel stays clean and flat.
6. Remove the protective film from the keypad seal (3).
7. Assemble the keypad to the panel (4). Use two screws provided.
8. Connect the 10 ft. cable at the keypad and P3 of the control (5).

Figure 3-2 Template (Size C, D, E and F)

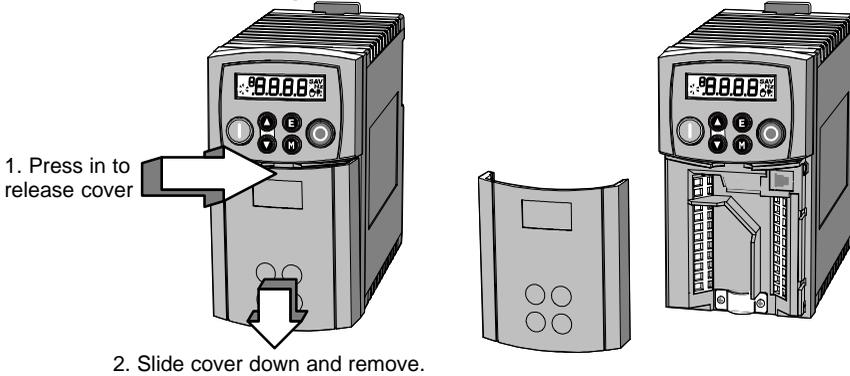


Cover Removal Size 1, 2 and 3

To connect power and signal wires, the cover must be removed. This procedure describes how to access all terminal connections inside the control.

Using your thumbs, press in and slide the cover down as shown in Figure 3-3.

Figure 3-3 Top Cover Removal

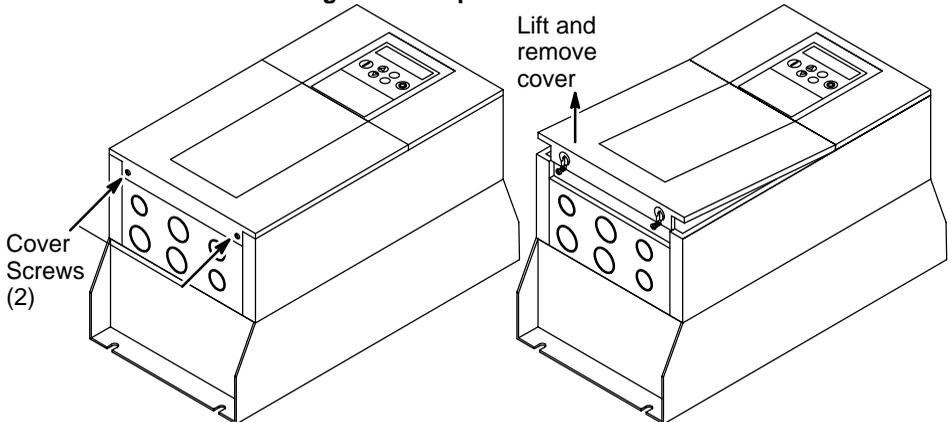


Size C, D, E and F

To connect power and signal wires, the cover must be removed. This procedure describes how to access all terminal connections inside the control.

1. Loosen the two cover screws shown in Figure 3-4.
2. Lift and remove the cover as shown.

Figure 3-4 Top Cover Removal



Power Conditioning

System Grounding Baldor Controls are designed to be powered from standard three phase power lines that are electrically symmetrical with respect to ground. System grounding is an important step in the overall installation to prevent problems. A four wire Wye connection is recommended.

Ungrounded Distribution System

With an ungrounded power distribution system it is possible to have a continuous current path to ground through the MOV devices. To avoid equipment damage, an isolation transformer with a grounded secondary is recommended. This provides three phase AC power that is symmetrical with respect to ground.

Input Power Conditioning

Baldor controls are designed for direct connection to standard three phase lines that are electrically symmetrical with respect to ground. Certain power line conditions must be avoided. An AC line reactor or an isolation transformer may be required for some power conditions.

- If the feeder or branch circuit that provides power to the control has permanently connected power factor correction capacitors, an input AC line reactor or an isolation transformer must be connected between the power factor correction capacitors and the control.
- If the feeder or branch circuit that provides power to the control has power factor correction capacitors that are switched on line and off line, the capacitors must not be switched while the control is connected to the AC power line. If the capacitors are switched on line while the control is still connected to the AC power line, additional protection is required. TVSS (Transient Voltage Surge Suppressor) of the proper rating must be installed between the AC line reactor or an isolation transformer and the AC input to the control.

Line Impedance The Baldor control requires a 1% line impedance minimum. If the impedance of the incoming power does not meet the requirement for the control, a 3 phase line reactor can be used to provide the needed impedance in most cases. Line reactors are optional and are available from Baldor.

The input impedance of the power lines can be determined as follows:

Measure the line to line voltage at no load and at full rated load.

Use these measured values to calculate impedance as follows:

$$\% \text{Impedance} = \frac{(\text{Volts}_{\text{No Load Speed}} - \text{Volts}_{\text{Full Load Speed}})}{(\text{Volts}_{\text{No Load Speed}})} \times 100$$

Line Reactors Three phase line reactors are available from Baldor. The line reactor to order is based on the full load current of the motor (FLA). If providing your own line reactor, use the following formula to calculate the minimum inductance required.

$$L = \frac{(V_{L-L} \times 0.03)}{(I \times \sqrt{3} \times 377)}$$

Where: L Minimum inductance in Henries.
V_{L-L} Input volts measured line to line.
0.03 Desired percentage of input impedance.
I Input current rating of control.
377 Constant used with 60Hz power.
Use 314 if input power is 50Hz.

Load Reactors Line reactors may be used at the control output to the motor. When used this way, they are called Load Reactors. Load reactors serve several functions that include:

- Protect the control from a short circuit at the motor.
 - Limit the rate of rise of motor surge currents.
 - Slowing the rate of change of power the control delivers to the motor.
- Load reactors should be installed as close to the control as possible. Selection should be based on the motor nameplate FLA value.

Power Disconnect A power disconnect should be installed between the input power service and the control for a fail safe method to disconnect power. The control will remain in a powered-up condition until all input power is removed from the control and the internal bus voltage is depleted.

Protective Devices Recommended fuse sizes are based on the following:
115% of maximum continuous current for time delay.
150% of maximum continuous current for Fast or Very Fast action.

Note: These general size recommendations do not consider harmonic currents or ambient temperatures greater than 40°C.

Be sure a suitable input power protection device is installed. Use the recommended fuses and wire sizes shown in Table 3-2 is based on the use of copper conductor wire rated at 75 °C. The table is specified for NEMA B motors.

Reduced Input Voltage Derating All power ratings stated in Section 6 are for the stated nominal AC input voltages (230 or 460VAC). The power rating of the control must be reduced when operating at a reduced input voltage. The amount of reduction is the ratio of the voltage change.

Examples:

A 5hp, 230VAC control operating at 208VAC has a reduced power rating of 4.5hp.

$$5\text{HP} \times \frac{208\text{VAC}}{230\text{VAC}} = 4.5\text{hp}$$

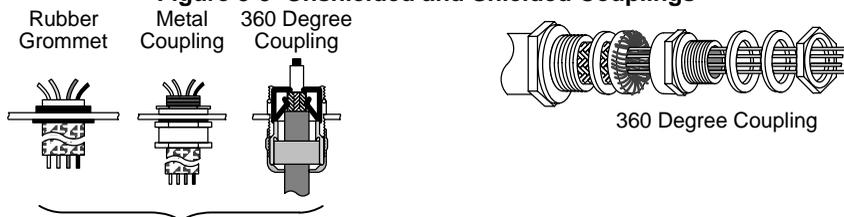
Likewise, a 3hp, 460VAC control operating at 380VAC has a reduced power rating of 2.47hp.

$$3\text{HP} \times \frac{380\text{VAC}}{460\text{VAC}} = 2.47\text{hp}$$

Electrical Installation

All interconnection wires between the control, AC power source, motor, host control and any operator interface stations should be in metal conduits or shielded cable must be used. Use listed closed loop connectors that are of appropriate size for wire gauge being used. Connectors are to be installed using crimp tool specified by the manufacturer of the connector. Only class 1 wiring should be used.

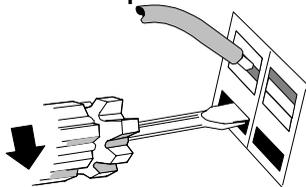
Figure 3-5 Unshielded and Shielded Couplings



Holes are required in the enclosure assembly to allow connections to be made. Use the correct size rubber grommet, conduit coupling or 360 degree coupling.

Clamp Terminals To install a wire into a clamp terminal, first strip wire insulation to 0.20–0.24 in. (5–6mm). Insert a flat-blade screwdriver, maximum blade size 0.138 in. (3.5mm) into the adjacent hole. Do not twist or rotate the screwdriver as this action may damage the terminal. A very slight downward pressure on the screwdriver should open the terminals and allow the wire to be inserted. Insert the wire into the clamp opening (Figure 3-6). Remove the screwdriver. The terminal provides the correct force for a secure connection.

Figure 3-6 Clamp Terminal



Power Connections

The signals are shown in Figure 3-7 and described in Table NO TAG.

1. Remove the cover, shown in Figure 3-3.
2. Loosen the grounded cable clamp, Figure 3-7.
3. Connect the Mains Cable, Motor Cable, Dynamic Brake Cable and Thermistor Cable wires, if used to their proper clamp terminal, Figure 3-7. Be sure the shields of all shielded cables are in contact with the grounded cable clamp.

Note: The series 37D control must have two separate mains earth grounds connected as shown in Figure 3-7.

4. Tighten the grounded cable clamp screws to securely hold the cables.

Table 3-2 Wire Size

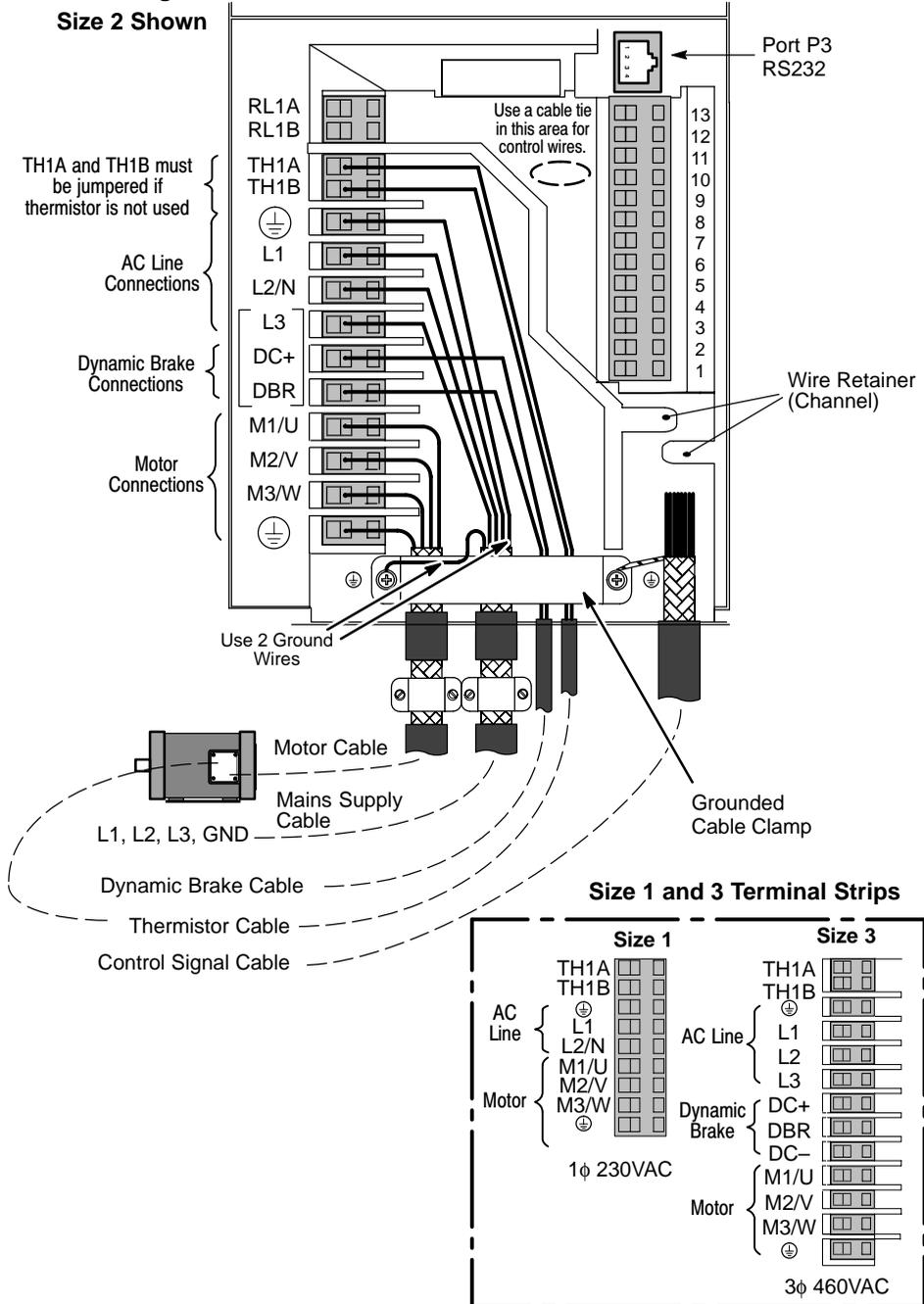
Catalog Number	Size	Input			Wire Size					
					L1, L2, L3, N, GND and Motor		DC+, DBR		TH1A, TH1B	
		Volts	Fuse (A)	PH	AWG	MM ²	AWG	MM ²	AWG	MM ²
ZD37D8A1F5-COD	1	230	10	1	12	3.31			12	3.31
ZD37D8A2F2-COD	1	230	10	1	12	3.31			12	3.31
ZD37D8A03-COD	1	230	10	1	12	3.31			12	3.31
ZD37D8A04-COD	1	230	15	1	12	3.31			12	3.31
ZD37D8A07-COD	2	230	20	1	12	3.31			12	3.31
ZD37D2A10-CRD	3	230	15	3	10	5.26	10	5.26	12	3.31
ZD37D2A16-CRD	3	230	20	3	10	5.26	10	5.26	12	3.31
ZD37D2A22-CRD	C	230	32	3	8	8.37	12	3.31	12	3.31
ZD37D2A28-CRD	C	230	40	3	8	8.37	12	3.31	12	3.31
ZD37D2A42-CRD	C	230	63	3	6	13.3	10	5.26	12	3.31
ZD37D2A54-CRD	D	230	80	3	4	21.2	8	8.37	12	3.31
ZD37D2A68-CRD	D	230	100	3	3	26.7	8	8.37	12	3.31
ZD37D2A80-CRD	E	230	125	3	2	33.6	8	8.37	12	3.31
ZD37D2A104-CRD1	F	230	150	3	1	42.4	8	8.37	12	3.31
ZD37D2A130-CRD1	F	230	175	3	2/0	67.4	8	8.37	12	3.31
ZD37D2A154-CRD1	F	230	200	3	3/0	85.0	8	8.37	12	3.31
ZD37D4A1F5-CRD	2	460	10	3	12	3.31	12	3.31	12	3.31
ZD37D4A02-CRD	2	460	10	3	12	3.31	12	3.31	12	3.31
ZD37D4A2F5-CRD	2	460	10	3	12	3.31	12	3.31	12	3.31
ZD37D4A4F5-CRD	2	460	10	3	12	3.31	12	3.31	12	3.31
ZD37D4A5F5-CRD	2	460	15	3	12	3.31	12	3.31	12	3.31
ZD37D4A09-CRD	3	460	20	3	10	5.26	10	5.26	12	3.31
ZD37D4A12-CRD	3	460	25	3	10	5.26	10	5.26	12	3.31
ZD37D4A16-CRD	3	460	30	3	10	5.26	10	5.26	12	3.31
ZD37D4A23-ERD	C	460	32	3	8	8.37	12	2.5	12	3.31
ZD37D4A27-ERD	C	460	40	3	8	8.37	12	2.5	12	3.31
ZD37D4A31-ERD	D	460	40	3	8	8.37	12	2.5	12	3.31
ZD37D4A38-ERD	D	460	50	3	8	8.37	10	5.26	12	3.31
ZD37D4A45-ERD	D	460	63	3	6	13.3	10	5.26	12	3.31
ZD37D4A52-ERD	D	460	80	3	4	21.2	8	8.37	12	3.31
ZD37D4A59-ERD	E	460	80	3	4	21.2	8	8.37	12	3.31
ZD37D4A73-ERD	E	460	100	3	3	26.7	8	8.37	12	3.31
ZD37D4A87-ERD	E	460	125	3	2	33.6	8	8.37	12	3.31
ZD37D4A105-CRD1	F	460	150	3	1	42.4	8	8.37	12	3.31
ZD37D4A125-CRD1	F	460	175	3	2/0	67.4	8	8.37	12	3.31
ZD37D4A156-CRD1	F	460	200	3	3/0	85.0	8	8.37	12	3.31
ZD37D4A180-CRD1	F	460	250	3	4/0	107	8	8.37	12	3.31

Note: All wire sizes are based on 75°C copper wire, 40°C ambient temperature, 4-6 conductors per conduit or raceway.

Size 1, 2 and 3 Power and Motor Connections

Terminal	Description	Function	Range		
			230V 1-Phase	230V 3-Phase	460V 3-Phase
RLY1	Relay Output	Normally open, programmable contact for a relay output.	Contact closes when the programmed condition (see Section 4) is true. No voltage is present on this contact. 6 conditions are available.		
TH1A	Thermistor	Connection to motor thermistor	It is good practice to protect motors by using thermistors. A typical resistance (up to a reference temperature of 125°C) is 200Ω, rising rapidly to 2000Ω above this temperature. Connect devices in series between TH1A and TH1B. Jumper TH1A and TH1B if temperature sensors are not used.		
TH1B	Thermistor	Connection to motor thermistor			
	Reference Terminal	Supply protective earth (PE). This terminal must be connected to a protective (earth) ground for permanent ground.			
L1	Power Input	Single and three phase line connection	220/240VAC±10% with respect to L2/N.	220/240VAC±10% with respect to L2/L3.	380/460VAC±10% with respect to L2/L3.
L2/N L2	Power Input	Single phase neutral (or L2 three phase line connection)	220/240VAC±10% with respect to L1.	220/240VAC±10% with respect to L1/L3.	380/460VAC±10% with respect to L1/L3.
L3	Power Input	Three phase line connection	Not applicable	220/240VAC±10% with respect to L1/L2.	380/460VAC±10% with respect to L1/L2.
DC-	No user connection				
DC+	Dynamic Brake	Connection to external brake resistor	Not applicable	Frame 3. See "Internal Dynamic Brake Switch" table	Frame 2 (high volt only) & 3. See "Internal Dynamic Brake Switch" table
DBR	Dynamic Brake	Connection to external brake resistor	Not applicable	Frame 3. See "Internal Dynamic Brake Switch" table	Frame 2 (high volt only) & 3. See "Internal Dynamic Brake Switch" table
M1/U M2/V M3/W	Power Outputs	3-phase supply connection for motor	0 to 220/240VAC 0 to 240Hz	0 to 220/240VAC 0 to 240Hz	0 to 380/460VAC 0 to 240Hz
	Reference Terminal	Supply protective earth (PE). This terminal must be connected to a protective (earth) ground for permanent ground.			

Figure 3-7 Size 1, 2, and 3 Power and Ground Connections

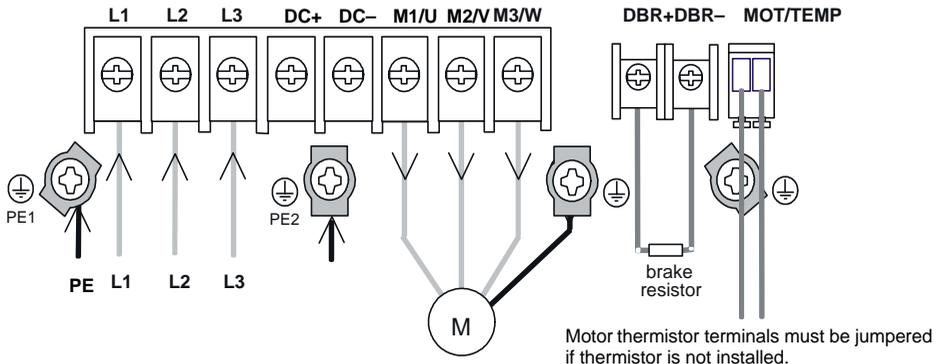


Size C Power and Motor Connections

Figure 3-8 shows the minimum connections required at the power connector. All cables must be shielded and the shields must be grounded at the knockout plate. The brake resistor and cable must be shielded if installed outside the enclosure.

1. Remove the terminal cover retaining screws and remove the terminal cover.
2. Lift the internal power terminal shield to allow connection of power and motor wires.
3. Feed the power supply and motor cables into the drive through the metal gland plate using the correct cable entries, and connect to the power terminals. Tighten power terminals to a torque of 12 lb-in (1.3Nm) – 5.5kW model, 16 lb-in (1.8Nm) – 7.5–11kW models; and earth terminals to 28 lb-in (3Nm). Tighten brake terminals to 12 lb-in (1.3Nm). Tighten thermistor terminals to 7 in-lb (0.8Nm).
4. Lower the internal power terminal shield.

Figure 3-8 Power Connections

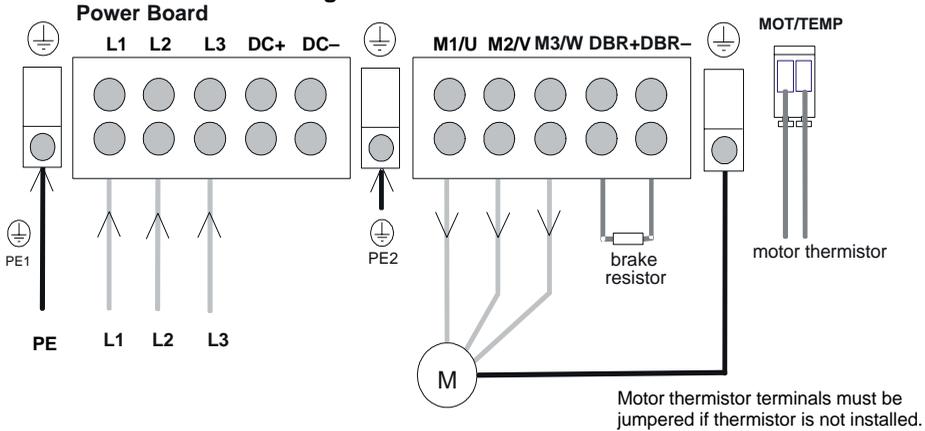


Size D Power and Motor Connections

Figure 3-9 shows the minimum connections required at the power connector. All cables must be shielded and the shields must be grounded at the knockout plate. The brake resistor and cable must be shielded if installed outside the enclosure.

1. Remove the terminal cover retaining screws and remove the terminal cover.
2. Lift the internal power terminal shield to allow connection of power and motor wires.
3. Feed the power supply and motor cables into the drive through the metal gland plate using the correct cable entries, and connect to the power terminals. Tighten the large terminals to a torque of 35 lb-in (4.0Nm), and earth terminals to 44 lb-in (5.0Nm). Tighten thermistor terminals to 7 in-lb (0.8Nm).
4. Lower the internal power terminal shield.

Figure 3-9 Power Connections

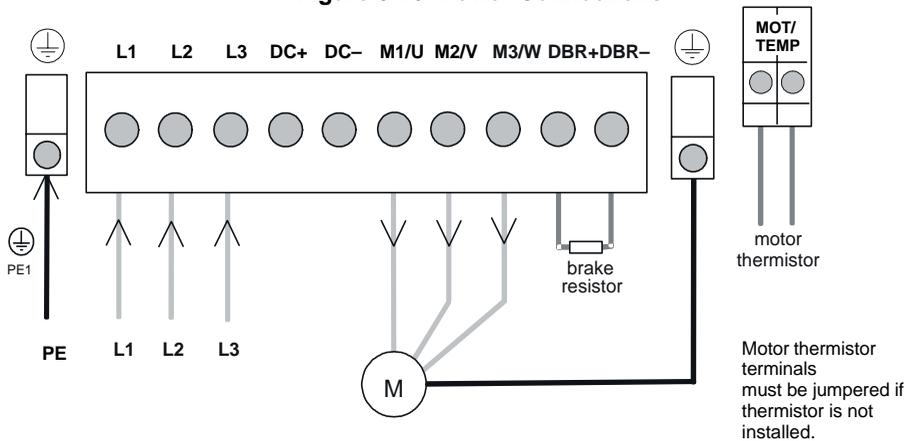


Size E Power and Motor Connections

Figure 3-10 shows the minimum connections required at the power connector. All cables must be shielded and the shields must be grounded at the knockout plate. The brake resistor and cable must be shielded if installed outside the enclosure.

1. Remove the terminal cover retaining screws and remove the terminal cover.
3. Feed the power supply and motor cables into the drive through the metal gland plate using the correct cable entries, and connect to the power terminals. Tighten the large terminals and earth terminals to 70 lb-in (8.0Nm). Tighten thermistor terminals to 7 in-lb (0.8Nm).
4. Lower the internal power terminal shield.

Figure 3-10 Power Connections

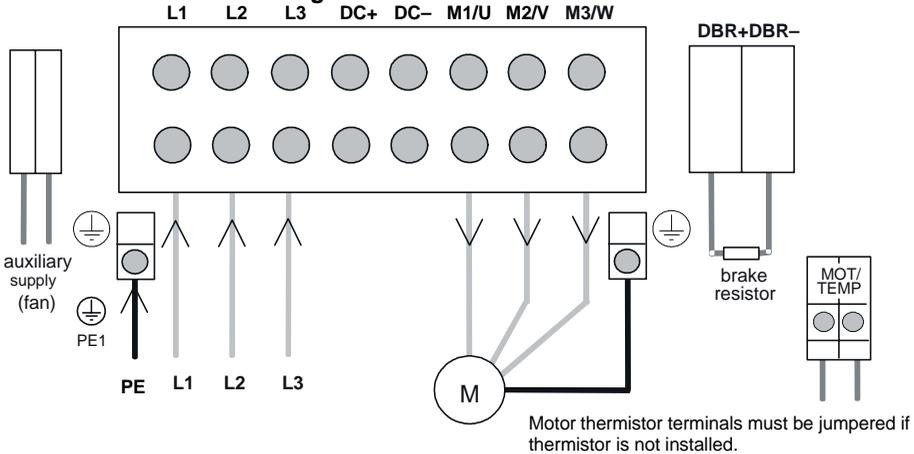


Size F Power and Motor Connections

Figure 3-11 shows the minimum connections required at the power connector. All cables must be shielded and the shields must be grounded at the knockout plate. The brake resistor and cable must be shielded if installed outside the enclosure.

1. Remove the terminal cover retaining screws and remove the terminal cover.
3. Feed the power supply and motor cables into the drive through the metal gland plate using the correct cable entries, and connect to the power terminals. Tighten the large terminals to a torque of 177 lb-in (20.0Nm), and earth terminals to 50 lb-in (6.0Nm). Tighten brake terminals to 16 in-lb (1.8Nm). Tighten thermistor and fan terminals to 6 in-lb (0.7Nm).
4. Lower the internal power terminal shield.

Figure 3-11 Power Connections



Thermistor Connections (connections are shown in Figures 3-8 to 3-11).

This input is provided for over-temperature detection for motors that have an internal thermistor. There is no polarity to the thermistor connections.

This provides “Basic” insulation only to the SELV control circuits and assumes the motor has “Basic” insulation to the windings/mains circuits.

The thermistor type supported is PTC ‘Type A’ as defined in IEC 34–11 Part 2. The resistance thresholds are:

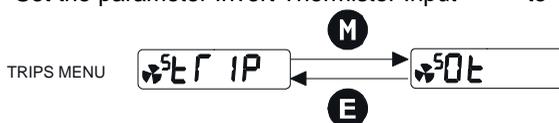
Rising temperature trip resistance:	1650 to 4000 ohms
Falling temperature trip reset resistance	750 to 1650 ohms

If the motor does not have an internal thermistor, you should disable the thermistor trip function by:

1. Connecting a jumper wire between the thermistor terminals TH1A and TH1B.

or

2. Set the parameter Invert Thermistor Input $50t$ to 1.

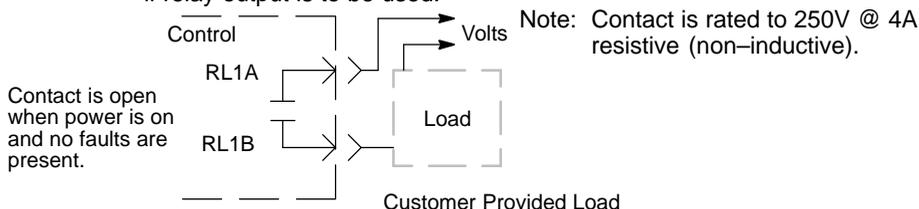


External Brake Resistor

For Size 2 and 3 controls, connect the dynamic brake resistor between terminals DC+ and DBR as shown in Figure 3-7.

For Size C to F controls, connect the dynamic brake resistor between terminals DBR+ and DBR– as shown in Figures 3-8 to 3-11.

User Relay A customer provided, external DC or AC power source must be used if relay output is to be used.



Contact is open when power is on and no faults are present.

Cooling Fan Size F enclosures provide terminals for connection of the cooling fan.

Figure 3-11 shows the terminals. Protect the fan by using a 3A fuse in the supply line. This fan provides 240cfm (410 m³/hr) at 200Pa.

Signal Connections

1. With the cover removed, connect the analog and digital inputs and outputs as shown in Figure 3-7.
The signals are described in Table 3-3.
2. Install the front cover.

Table 3-3 Analog/Digital Signal Descriptions

Terminal (SELV)	Signal Name	Description	Range
P3		RS232 port for use with remote mounted keypad.	
RL1A	User Relay	Volt-free contact - 4A maximum, non-inductive	0-250VAC/24VDC
RL1B	User Relay	Volt-free contact - 4A maximum, non-inductive	0-250VAC/24VDC
13	DIN7 (ENC B)	Configurable digital input or digital output. See Operating Modes 0-8 for function definition. For Encoder Follower mode, used as the Encoder B channel signal input.	0-24V source open collector
12	DIN6 (ENC A)	Configurable digital input or digital output. See Operating Modes 0-8 for function definition. For Encoder Follower mode, used as the Encoder A channel signal input.	0-24V source open collector
11	DIN5	Configurable digital input or digital output. See Operating Modes 0-8 for function definition.	0-24V source open collector
10	DIN4/ DOUT2	Configurable digital input or digital output (output is source, open collector, 20mA maximum). See Operating Modes 0-8 for function definition.	0-24V source open collector
9	DIN3/ DOUT1	Configurable digital input or digital output (output is source, open collector, 20mA maximum). See Operating Modes 0-8 for function definition.	0-24V source open collector
8	DIN2	Digital Input 2.	0-24V
7	DIN1	Digital Input 1.	0-24V
6	+24V	24V - 24V supply for digital I/O	50mA max
5	AOUT1	Analog Output - 10mA maximum	0-10V
4	10VREF	10V reference (10mA maximum loading)	10V
3	AIN2	Analog Input 2	0-10V, 4-20mA
2	AIN1	Analog Input 1 - Setpoint. If unused, connect to 0VDC.	0-10V
1	0V	0V - Reference for Analog/Digital I/O For single control installations, connect pin 1 (0V) to PE. For multiple control installations, connect the 0V terminals of each control together. Then connect only one control to PE.	0V

Applications/Operating Modes There are 8 operating modes. Each mode configures the terminal strip wiring for a specific application. The following diagrams document the terminal strip wiring for each (Application 0 to Application 8).

Note: Parameter values are not changed by loading a new Application.

How to Load an Application

In the **PAR** menu, go to **P I** and press the  key.
The Applications are stored in this menu.

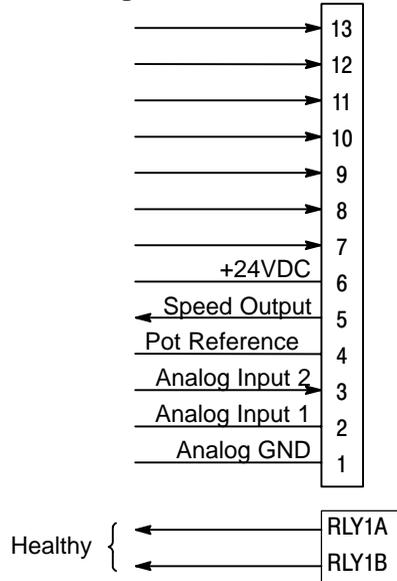
Use the   keys to select the appropriate Application by number.

Press the  key to load the Application.

1 – Keypad Mode

In Keypad mode, the control is operated by the keypad and opto isolated inputs and the analog command inputs are ignored. The analog output remain active.

Figure 3-12 Keypad Connection Diagram



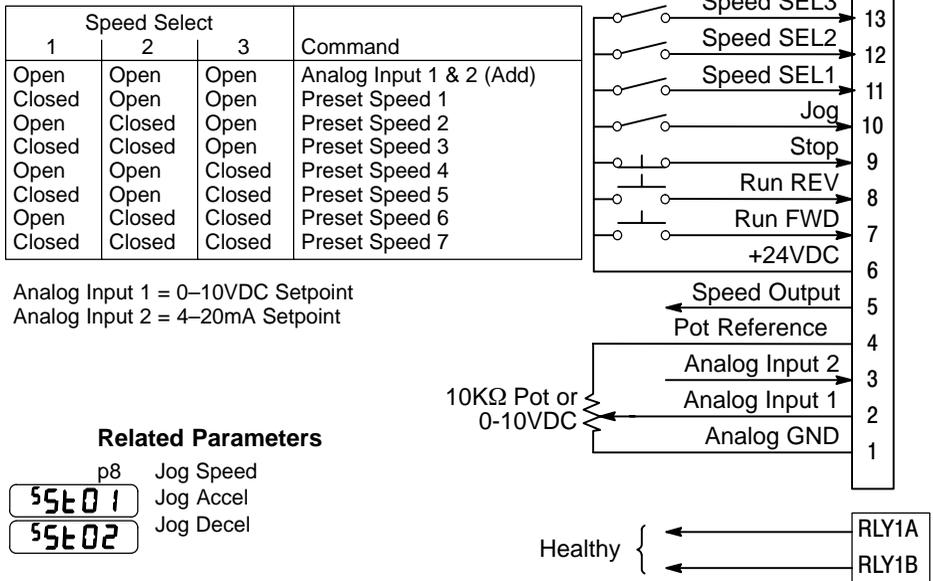
- 1 Analog GND. Reference for analog inputs.
- 2 Not used.
- 3 Not used.
- 4 +10VDC reference voltage for potentiometer.
- 5 Analog output that represents the commanded speed output.
- 6 +24VDC for Optical Inputs power.
- 7 Not used.
- 8 Not used.
- 9 Not used.
- 10 Not used.
- 11 Not used.
- 12 Not used.
- 13 Not used.

RLY1 Digital output that represents the fault status "Healthy".

2 – Standard Run 3 Wire Mode

In Standard Run mode, the control is operated by the opto isolated inputs and the analog command input. The opto inputs can be switches as shown in Figure 3-13 or logic signals from another device.

Figure 3-13 Standard Run Connection Diagram

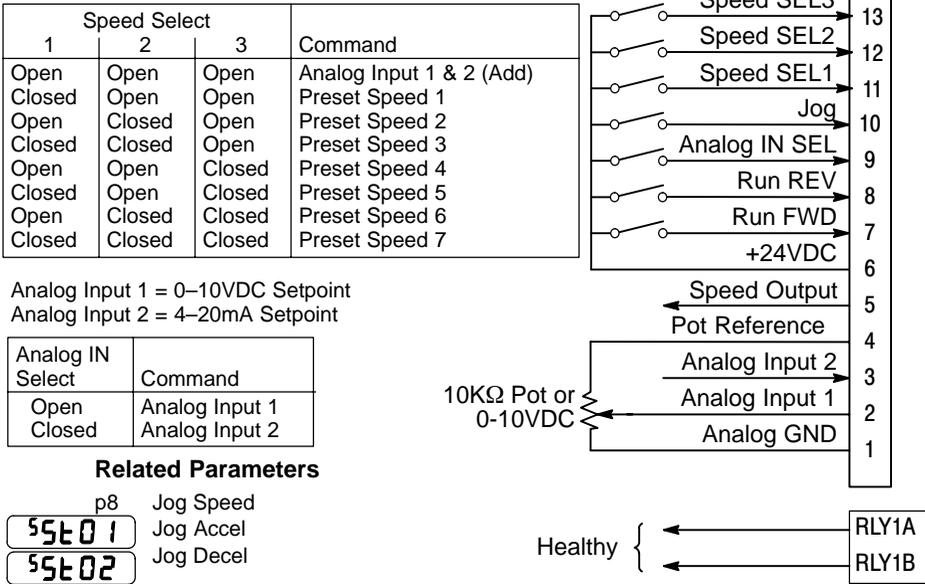


- 1 Analog GND. Reference for analog inputs.
 - 2 Setpoint 0–10VDC. Single ended analog voltage input, referenced to 1.
 - 3 Setpoint 4–20mA. Single ended analog current input, referenced to 1.
 - 4 +10VDC reference voltage for potentiometer.
 - 5 Analog output that represents the commanded speed output.
 - 6 +24VDC for Optical Inputs power.
 - 7 Momentary CLOSED starts motor operation in the Forward direction.
 - 8 Momentary CLOSED starts motor operation in the Reverse direction.
 - 9 Momentary OPEN motor decels to stop.
 - 10 CLOSED places control in JOG mode, Forward and Reverse run are used to jog the motor.
 - 11 Speed Select 1, selects preset speeds 1–7.
 - 12 Speed Select 2, selects preset speeds 1–7.
 - 13 Speed Select 3, selects preset speeds 1–7.
- RLY1 Digital output that represents the fault status “Healthy”.

3 – 8 Speed 2 Wire Mode

In 8 Speed mode, the control is operated by the opto isolated inputs and the analog command input. The opto inputs can be switches as shown in Figure 3-14 or logic signals from another device.

Figure 3-14 8 Speed Connection Diagram



- 1 0VDC Reference for analog inputs.
 - 2 Setpoint 0–10VDC. Single ended analog voltage input, referenced to 1.
 - 3 Setpoint 4–20mA. Single ended analog current input, referenced to 1.
 - 4 +10VDC reference voltage for potentiometer.
 - 5 Analog output that represents the commanded speed output.
 - 6 +24VDC for Optical Inputs power.
 - 7 CLOSED starts motor operation in the Forward direction. In JOG mode (10 Closed), continuous Closed jogs motor in the Forward direction.
 - 8 CLOSED starts motor operation in the Reverse direction. In JOG mode (10 Closed), continuous closed JOGS motor in the Reverse direction.
 - 9 OPEN selects Analog Input 1 (2).
CLOSED selects Analog Input 2 (3).
 - 10 CLOSED places control in JOG mode, Forward and Reverse run are used to jog the motor.
 - 11 Speed Select 1, selects preset speeds 1–7.
 - 12 Speed Select 2, selects preset speeds 1–7.
 - 13 Speed Select 3, selects preset speeds 1–7.
- RLY1 Digital output that represents the fault status “Healthy”.

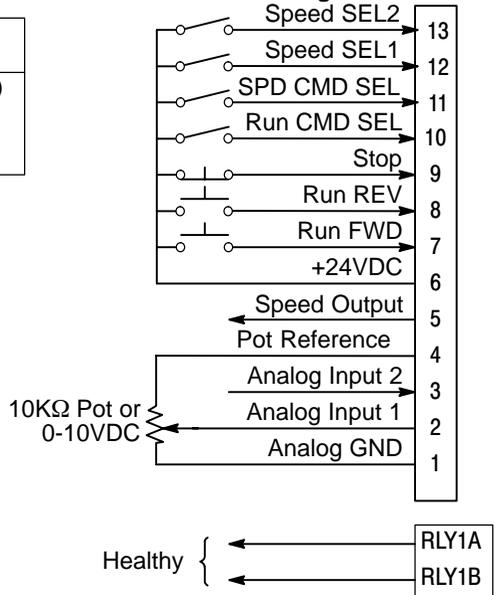
4 – 3 Speed Command Select 3 Wire Mode

In 3 speed 3 wire mode, the control is operated by the opto isolated inputs and the analog command input. The opto inputs can be switches as shown in Figure 3-15 or logic signals from another device.

Figure 3-15 3 Speed Command Select Connection Diagram

Speed Select 1	Speed Select 2	Command
Open	Open	Analog Input 1 & 2 (Add)
Closed	Open	Preset Speed 1
Open	Closed	Preset Speed 2
Closed	Closed	Preset Speed 3

Analog Input 1 = 0–10VDC Setpoint
 Analog Input 2 = 4–20mA Setpoint



- 1 0VDC Reference for analog inputs.
 - 2 Setpoint 0–10VDC. Single ended analog voltage input, referenced to 1.
 - 3 Setpoint 4–20mA. Single ended analog current input, referenced to 1.
 - 4 +10VDC reference voltage for potentiometer.
 - 5 Analog output that represents the commanded speed output.
 - 6 +24VDC for Optical Inputs power.
 - 7 Momentary CLOSED starts motor operation in the Forward direction.
 - 8 Momentary CLOSED starts motor operation in the Reverse direction.
 - 9 Momentary OPEN motor decels to stop.
 - 10 CLOSED selects Stop/Start and Reset commands from the terminal strip. OPEN selects Stop/Start and Reset commands from the keypad.
 - 11 CLOSED selects speed commands defined in the table of Figure 3-15. OPEN selects speed commands from the keypad.
 - 12 Speed Select 1, selects preset speeds 1–3.
 - 13 Speed Select 2, selects preset speeds 1–3.
- RLY1 Digital output that represents the fault status “Healthy”.

5 – 3 Speed Command Select 2 Wire Mode

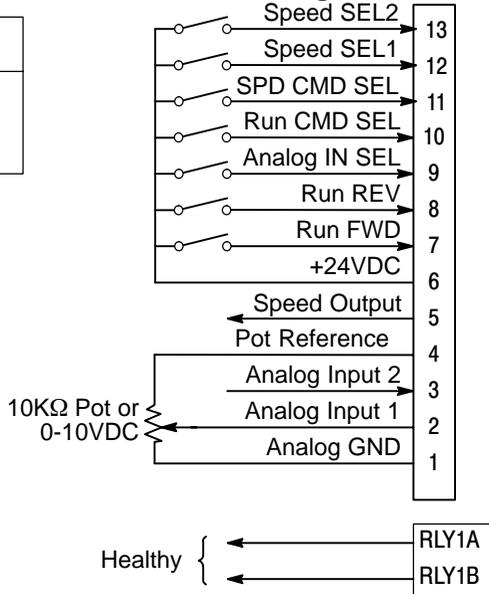
In 3 speed 2 wire mode, the control is operated by the opto isolated inputs and the analog command input. The opto inputs can be switches as shown in Figure 3-16 or logic signals from another device.

Figure 3-16 3 Speed Command Select Connection Diagram

Speed Select 1	Speed Select 2	Command
Open	Open	Analog Input
Closed	Open	Preset Speed 1
Open	Closed	Preset Speed 2
Closed	Closed	Preset Speed 3

Analog Input 1 = 0–10VDC Setpoint
 Analog Input 2 = 4–20mA Setpoint

Analog IN Select	Command
Open	Analog Input 1
Closed	Analog Input 2



- 1 0VDC Reference for analog inputs.
 - 2 Setpoint 0–10VDC. Single ended analog voltage input, referenced to 1.
 - 3 Setpoint 4–20mA. Single ended analog current input, referenced to 1.
 - 4 +10VDC reference voltage for potentiometer.
 - 5 Analog output that represents the commanded speed output.
 - 6 +24VDC for Optical Inputs power.
 - 7 CLOSED starts motor operation in the Forward direction.
 - 8 CLOSED starts motor operation in the Reverse direction.
 - 9 Analog IN Select. OPEN selects Analog Input 1 (2).
CLOSED selects Analog Input 2 (3).
 - 10 CLOSED selects Stop/Start and Reset commands from the terminal strip.
OPEN selects Stop/Start and Reset commands from the keypad.
 - 11 CLOSED selects speed commands defined in the table of Figure 3-16.
OPEN selects speed commands from the keypad.
 - 12 Speed Select 1, selects preset speeds 1–3.
 - 13 Speed Select 2, selects preset speeds 1–3.
- RLY1 Digital output that represents the fault status “Healthy”.

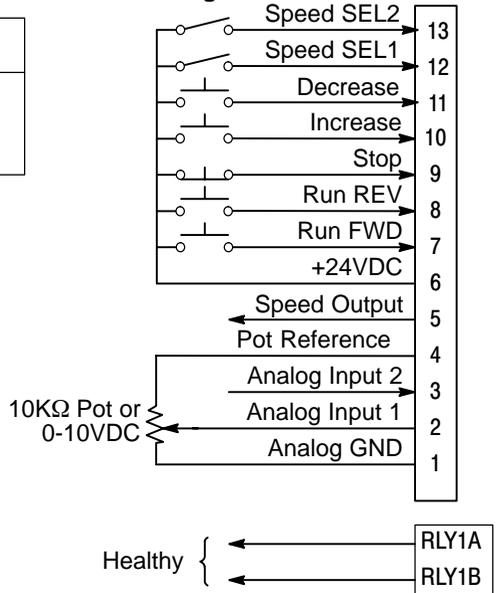
6 – EPOT 3 Wire Mode

In EPOT 3 wire mode, the control is operated by the opto isolated inputs and the analog command input. The opto inputs can be switches as shown in Figure 3-17 or logic signals from another device.

Figure 3-17 EPOT Connection Diagram

Speed Select 1	Speed Select 2	Command
Open	Open	EPOT
Closed	Open	Analog Input 1
Open	Closed	Analog Input 2
Closed	Closed	Preset Speed 1

Analog Input 1 = 0–10VDC Setpoint
 Analog Input 2 = 4–20mA Setpoint

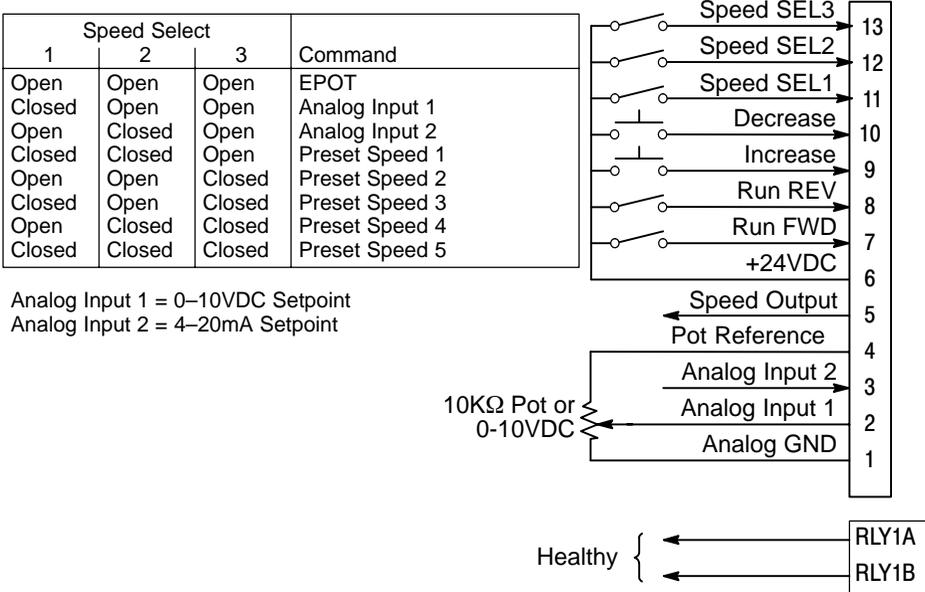


- 1 0VDC Reference for analog inputs.
 - 2 Setpoint 0–10VDC. Single ended analog voltage input, referenced to 1.
 - 3 Setpoint 4–20mA. Single ended analog current input, referenced to 1.
 - 4 +10VDC reference voltage for potentiometer.
 - 5 Analog output that represents the commanded speed output.
 - 6 +24VDC for Optical Inputs power.
 - 7 Momentary CLOSED starts motor operation in the Forward direction.
 - 8 Momentary CLOSED starts motor operation in the Reverse direction.
 - 9 Momentary OPEN motor decels to stop.
 - 10 Momentary CLOSED increases motor speed while the contact is closed.
 - 11 Momentary CLOSED decreases motor speed while the contact is closed.
 - 12 Speed Select 1, selects preset speeds 1–3.
 - 13 Speed Select 2, selects preset speeds 1–3.
- RLY1 Digital output that represents the fault status “Healthy”.

7 – EPOT 2 Wire Mode (Electronic Potentiometer)

In EPOT 2 wire mode, the control is operated by the opto isolated inputs and the analog command input. The opto inputs can be switches as shown in Figure 3-18 or logic signals from another device.

Figure 3-18 EPOT Connection Diagram



- 1 0VDC Reference for analog inputs.
 - 2 Setpoint 0–10VDC. Single ended analog voltage input, referenced to 1.
 - 3 Setpoint 4–20mA. Single ended analog current input, referenced to 1.
 - 4 +10VDC reference voltage for potentiometer.
 - 5 Analog output that represents the commanded speed output.
 - 6 +24VDC for Optical Inputs power.
 - 7 CLOSED starts motor operation in the Forward direction.
 - 8 CLOSED starts motor operation in the Reverse direction.
 - 9 Momentary CLOSED increases motor speed while the contact is closed.
 - 10 Momentary CLOSED decreases motor speed while the contact is closed.
 - 11 Speed Select 1, selects preset speeds 1–5.
 - 12 Speed Select 2, selects preset speeds 1–5.
 - 13 Speed Select 3, selects preset speeds 1–5.
- RLY1 Digital output that represents the fault status “Healthy”.

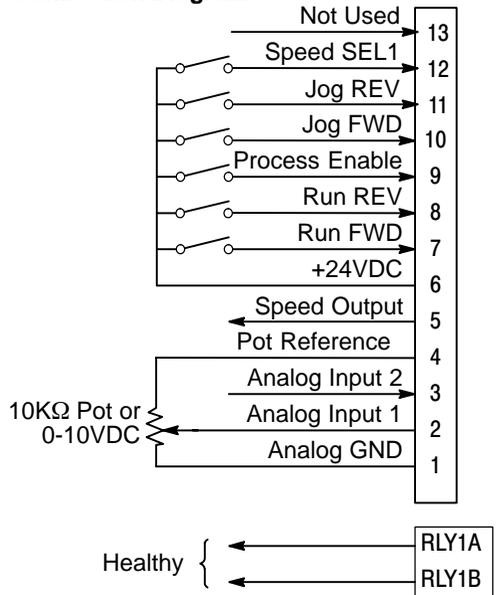
8 – PID 2 Wire Mode

In PID 2 wire mode, the control is operated by the opto isolated inputs and the analog command input. The opto inputs can be switches as shown in Figure 3-19 or logic signals from another device.

Figure 3-19 PID Connection Diagram

Speed Select 1	Command
Open	PID
Closed	Preset Speed 1

Analog Input 1 = 0–10VDC Setpoint
 Analog Input 2 = 4–20mA Setpoint



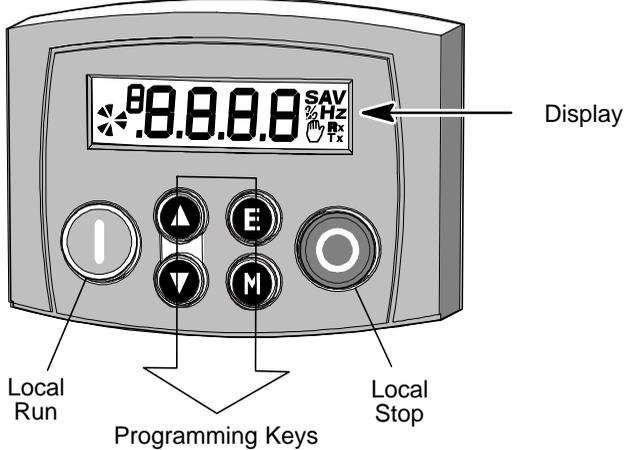
- 1 0VDC Reference for analog inputs.
 - 2 PID Setpoint 0–10VDC. Single ended analog voltage input, referenced to 1.
 - 3 PID Feedback 4–20mA. Single ended analog current input, referenced to 1.
 - 4 +10VDC reference voltage for potentiometer.
 - 5 Analog output that represents the commanded speed output.
 - 6 +24VDC for Optical Inputs power.
 - 7 CLOSED starts motor operation in the Forward direction.
 - 8 CLOSED starts motor operation in the Reverse direction.
 - 9 CLOSED enables the process mode.
 - 10 CLOSED causes the motor to JOG in the Forward direction.
 - 11 CLOSED causes the motor to JOG in the Reverse direction.
 - 12 CLOSED selects Preset Speed 1.
OPEN selects PID.
 - 13 Not used.
- RLY1 Digital output that represents the fault status “Healthy”.

9 – Reserved

Section 4 Start-Up and Operation

Keypad Description

Figure 4-1 Keypad Description



Key	Operation	Description
	Escape	Navigation – Displays the previous level's menu Parameter – Returns to the parameter list Trip Acknowledge – Acknowledges displayed Trip or Error message
	Menu	Navigation – Displays the next menu level, or the first parameter of the current Menu Parameter – Moves cursor to the left when the parameter is adjustable
	Increment	Navigation – Move upwards through the menu system Parameter – Increase value of the displayed parameter Local Mode – Increase value of the local setpoint
	Decrement	Navigation – Move down through the menu system Parameter – Decrease value of the displayed parameter Local Mode – Decrease value of the local setpoint
	Run	Local Mode – Run the drive
	Stop	Local Mode – Stops the drive. Trip Reset in all modes Navigation – Press and hold to toggle between Local and Remote Control modes (refer to Special Menu Features)

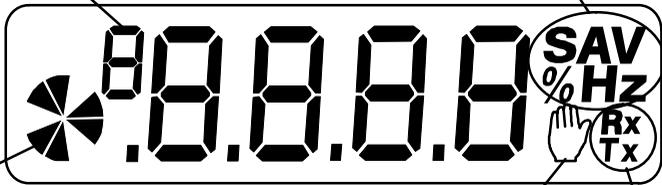
The keypad provides local control, monitoring, and complete access for application programming. Remove it by simply pulling it from the drive. To install it, push it back into place. The keypad can be remote-mounted up to 10 feet (3 meters) from the control (see Section 3).

Display

- P** when in the Parameter menu
S when in the Setup menu
A when displaying an Alarm code
 - a negative parameter value

Displays the units for the value:

- S** for time in seconds, **A** for current in Amps
V for voltage in Volts, **%** for percentage
Hz for frequency in Hertz



Represents a rotating motor shaft:
 CW = forward rotation
 CCW = reverse rotation.

Not Used

Parameter numbers or values, trip information, error codes etc. See Drive Status Indications.

Local mode.
 (Remote mode when hand is not visible.)

Drive Status Indications (shown on keypad)

Display	Status Indication and Meaning	Possible Cause
rdy	READY/HEALTHY No alarms present. Remote mode selected	
PASS	PASSWORD Current password must be entered before this parameter may be altered.	Enter password to change the parameter. (See password protection).
LOC	LOCAL Local mode selected	Added or removed from the display letter-by-letter to indicate entering or leaving Local mode

Diagnostics Menu

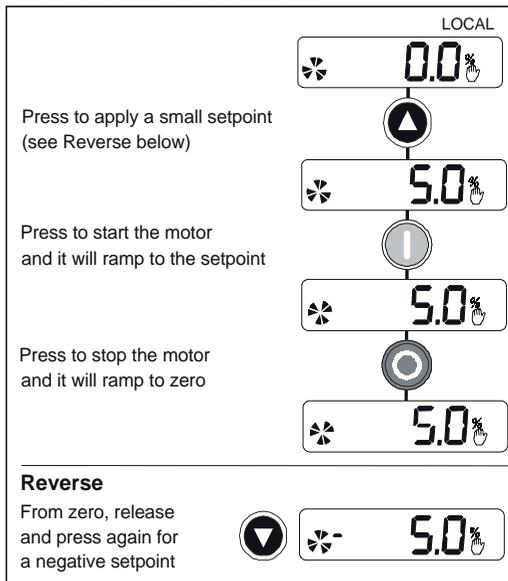
Display	Name	Description
0.0 Hz	Frequency	The current output frequency in Hertz
0.0 %	Speed Setpoint	The set point as a percentage of MAX Frequency
0.0 v	DC Link Volts	VAC $\sqrt{2}$ = dc link Volts
0.0 A	Motor Current	The current load value in Amps

Power Up Local mode is the most simple operating mode. Local mode only allows inverter operation (VOLTS/Hz). On initial power-up, the drive is in Local control mode and the keypad will display the Local Setpoint.

0.0 Hz. If not, refer to Troubleshooting in Section 5 and select Local Control.

All parameters are at factory settings. Any changes to these conditions are automatically saved. The drive will initialize on subsequent power-ups with the previously saved settings and control mode.

Verify operation in the local mode as follows:



The drive will operate as an open-loop drive. Use the keypad to change parameters to meet your application if necessary. The complete list of parameters is provided later in this section, but Tables 4-4 and 4-5 describe the most common parameters to customize for V/Hz or Encoderless Vector operation.

Note: For V/Hz operation, autotune is not necessary. For encoderless vector operation, you must autotune (described later in this section).

Table 4-4 Common Parameters for V/Hz Operation

Display	Parameter	Description	Factory Setting
P 2	MAX Frequency	The maximum operating frequency (when the maximum setpoint is applied).	60Hz
P 3	MIN Frequency	Minimum speed clamp.	0.0%
P 4	ACCEL Time	The time required for the output frequency to ramp from zero to MAX FREQUENCY.	5.0s
P 5	DECEL Time	The time required for the output frequency to ramp from MAX FREQUENCY to zero.	5.0s
P 6	Motor Rated Current	The motor full-load current stated on the nameplate.	–
P 7	Control Base Frequency	The output frequency at which maximum voltage is reached.	–
P 8	JOG Setpoint	The speed setpoint for Jog moves.	12.0%
P 9	Run Stop Mode	Selects a type of “ramp to stop” to use when the RUN signal is removed.	0
P 11	V/F Shape	Constant torque V to F characteristic.	Linear
P 12	Heavy/Normal Duty	Selects Constant or Quadratic mode of operation.	0
P 13	Torque Boost	Boosts starting torque by adding volts at low speed.	–
5CLO1	Control Mode	This parameter contains the main method of motor control used by the drive.	0 Volts/Hz

Table 4-4 Common Parameters for V/Hz Operation Continued

Additional V/Hz parameters if 5CLO4 or 5CLO5 are enabled.

Display	Parameter	Description	Factory Setting
5CLO2	Motor Rated Speed	Rated motor full-load speed.	1445.0
5CL11	Motor Poles	Motor pole pairs stated on nameplate.	1 (4 pole)
5CL12	Motor Rated Volts	Motor operating voltage stated on nameplate.	–
5CL14	MAG Current	The motor no-load AC line current stated on nameplate (or determined during autotune). Also called Load Current.	–

Table 4-5 Common Parameters for Encoderless Flux Vector Operation

Display	Parameter	Description	Factory Setting
P 2	MAX Frequency	The maximum operating frequency (when the maximum setpoint is applied).	60Hz
P 3	MIN Frequency	Minimum speed clamp.	0.0%
P 4	ACCEL Time	The time required for the output frequency to ramp from zero to MAX Frequency.	5.0s
P 5	DECEL Time	The time required for the output frequency to ramp from MAX Frequency to zero.	5.0s
P 6	Motor Rated Current	The motor full-load current stated on the nameplate.	–
P 7	Control Base Frequency	The output frequency at which maximum voltage is reached.	–
P 8	JOG Setpoint	The speed setpoint for Jog moves.	12.0%
P 9	Run Stop Mode	Selects a type of “ramp to stop” to use when the RUN signal is removed.	0
P 12	Heavy/Normal Duty	Selects Constant or Quadratic mode of operation.	0
5CL01	Control Mode	This parameter contains the main method of motor control used by the drive.	0 Volts/Hz
5CL02	Motor Rated Speed	Rated motor full-load speed.	1445.0
5CL11	Motor Poles	Motor pole pairs stated on nameplate.	1 (4 pole)
5CL12	Motor Rated Volts	Motor rated voltage stated on the motor nameplate.	–
5CL20	Autotune Mode	Selects the Autotune operating mode.	0
5CL21	Autotune Enable	Enable or disable Autotune. Autotune is enabled when set to TRUE and the drive is run.	0

Autotune Autotune can be performed with the motor shaft stationary or rotating. Rotating is preferred but if the load is attached to the motor shaft, use the stationary procedure.

Enter values for the following parameters before Autotune.

- Motor Rated Current
- Control Base Frequency
- Motor Rated Voltage
- Motor Rated Speed
- Motor Poles

Rotating Autotune (Motor shaft must spin freely, no load)

During autotune, the motor will spin up to the maximum speed set by the user. This is necessary to identify all necessary motor characteristics.

1. Verify that the motor can rotate freely in the forward direction.
2. Ensure also that the motor is unloaded. Ideally, the motor shaft should be disconnected from the load. If the motor is connected to a gearbox this is ok, provided that there is nothing on the output of the gearbox which could load the motor.
3. Set MAX Frequency to the maximum motor speed you will operate the drive during normal operation. The Autotune will characterize the motor up to 30% above this speed. If you later wish to run faster than this, you will need re-do autotune with a different MAX Speed value.
4. Set the Autotune Mode parameter to (1) Rotating.
5. Set Autotune Enable to 1 (true), and press the RUN key. **ALN** on the keypad display indicates the drive has started a rotating autotune. Autotune may take several minutes. The motor will be accelerated to maximum speed and then brought to a stop. When complete, the drive is stopped and the Autotune Enable parameter is reset to 0 (false).

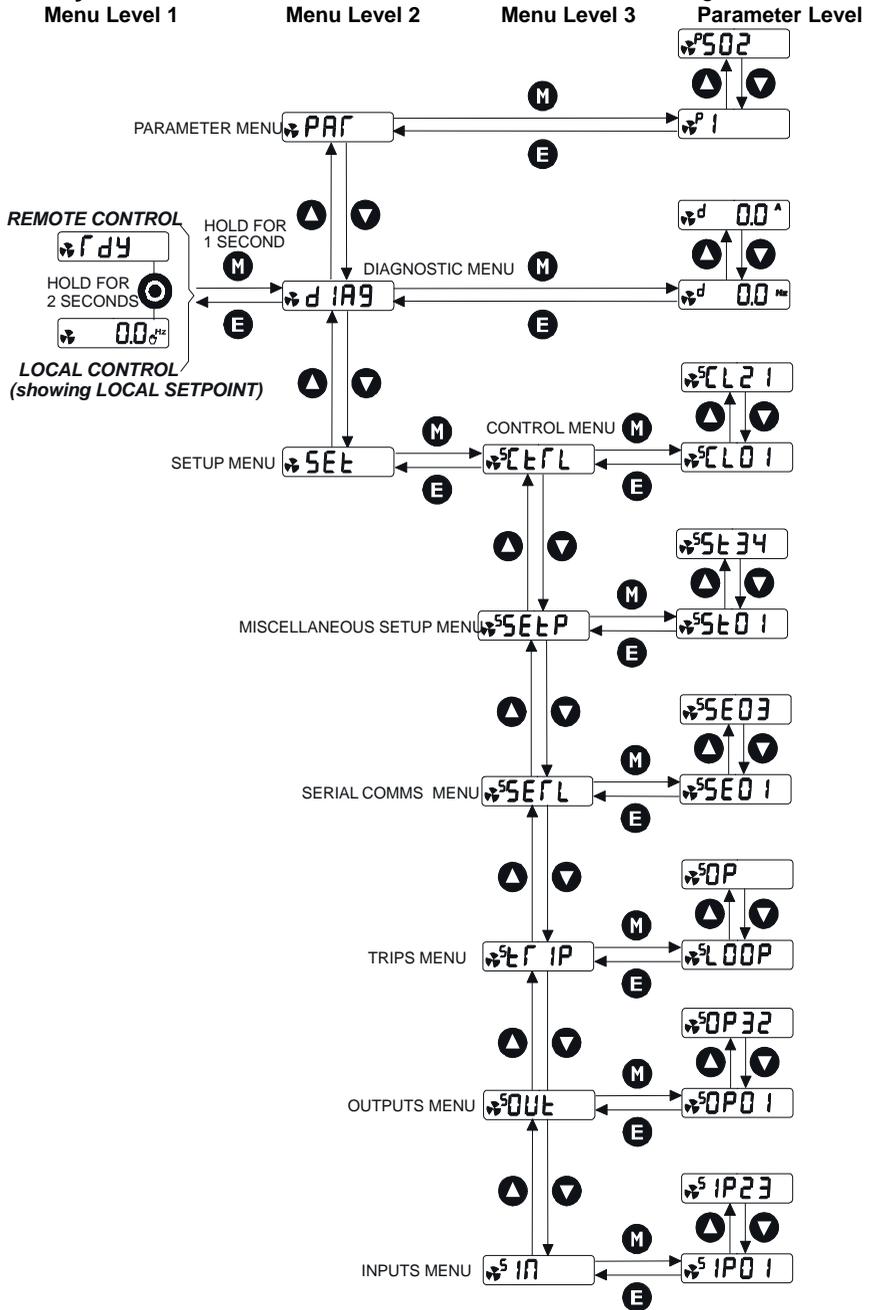
Stationary Autotune (Only used when motor cannot spin freely)

During stationary Autotune, the Motor does not spin. A limited set of motor characteristics are identified.

1. Enter the correct value of magnetizing current usually on the motor nameplate, also called load current.
2. Set Autotune Enable to 1 (true), and press the RUN key. **ALN** on the keypad display indicates the drive has started a rotating autotune. Autotune may take several minutes. During stationary autotune, the control injects current into the motor windings but does not rotate the shaft. When complete, the drive is returned to the stopped condition and the Autotune Enable parameter is reset to 0 (false).

Do not operate the drive above base speed.

Menu System There are three menu levels as shown in this diagram:



How to Change a Parameter Value

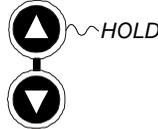
You can change the values of parameters stored in the **PAR** and **SET** menus. Refer to “Parameter Definitions” for further information.

- View the parameter to be edited and press  to display the parameter's value.
- Select the digit to be changed (pressing the  key moves the cursor from right to left).
- Use the   keys to adjust the value. Press the key momentarily to adjust the value slowly, or hold the key longer to make rapid changes; the rate of change varies with the time held.
- Press  to return to the parameter display. The new value is stored.

Special Menu Features

Reset to Factory Settings (2 button Reset)

Turn power on while pressing the  and  keys. This loads or restores the factory settings and application 1.



Then press



Select Local or Remote

Remote Control Mode: Allows control and monitoring of the drive using digital and analog inputs and outputs. Local control keys are inactive when Remote control mode is selected. In remote mode, the control uses a remote speed command (analog Input 1).

Local Control Mode: Provides local control and monitoring of the drive using the keypad. In local mode, the control uses the local speed command parameter and the value is adjusted using the keypad.

Note: You can only change between Local and Remote control when the control is “stopped”, and either  or the Local Setpoint is displayed.

Remote to Local



Hold this key down until the display shows 



REMOTE



Hold this key down until the display spells 



LOCAL

Note: For safety reasons, the control will not return to Remote mode if this will cause the drive to start. Verify that the RUN and JOG inputs are low.

Special Menu Features Continued

Quick Application Selection

Press and hold the Stop key. 

Power up the control.

Continue to hold the key for at least 1 second.

You can navigate immediately to the application parameter, P1, from this power-up condition.

Then, press the  key to display the active application.

Use the   keys to select the appropriate application by number.

Press the  key to load the selected application.

Password Protection

When activated, the password prevents unauthorized parameter modification by making all parameters "read-only". Password protection is set-up using the **P 99** parameter.

Steps	ACTIVATE	
	Actions	Display
1	Go to P 99 Press 	0000
2	Use  to enter new password	000 1 For example
3	Press  until top menu is reached	r d y Remote or local setpoint
4	Press  to activate password	r d y Remote or local setpoint

Default = 0000, de-activated. Any other value is a password

Special Menu Features Continued

Steps	TEMPORARY DE-ACTIVATION	
	Actions	Display
1	Try to edit any parameter with password activated	PASS 0000
2	Use   to enter password	000 1 For example
3	Press 	Original parameter displayed, password de-activated
A drive will power-up with the last password status. Temporary de-activation is lost on power-down.		

Steps	REMOVE PASSWORD	
	Actions	Display
1	Go to P 99 Press 	PASS 0000
2		000 1 For example
3	Press  Reset to 0000 using  	0000
4	Press  to remove password	P 99

Parameter Definitions

You can program the Inverter for specific applications. The Inverter is supplied with pre-programmed applications that can be used as starting points for application-specific programming. Programming is simply selecting an application, changing some of the parameter values and finally saving the changes. Each application configures the terminal wiring for a differently. The Inverter retains the new settings during power-down. The next time the inverter is powered up, the new settings will be used.

Table 4-1 Parameter Definitions

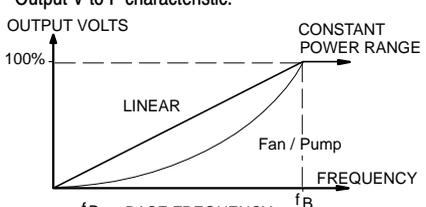
Display	Parameter	Description	Range	Factory Setting
P 1	Application	Selects the application to be used Application 1: Keypad Application 2: Standard Run 3-Wire Application 3: 8 Speed 2-Wire Application 4: 3 Speed Command Select 3-Wire Application 5: 3 Speed Command Select 2-Wire Application 6: EPOT 3-Wire Application 7: EPOT 2-Wire Application 8: PID 2-Wire	0= Application 0 1= Application 1 2= Application 2 3= Application 3 4= Application 4 5= Application 5 6= Application 6 7= Application 7 8= Application 8	1
P 2	MAX Frequency	The frequency at which the control will run when maximum setpoint is applied.	7.5 to 240.0Hz	60.0Hz
P 3	MIN Frequency	The minimum frequency at which the control will run.	-100.0 to 100.0%	0.0%
P 4	ACCEL Time	The time taken for the control output frequency to ramp up from zero to MAX FREQUENCY.	0.0 to 3000.0s	5.0s
P 5	DECEL Time	The time taken for the control output frequency to ramp down from MAX FREQUENCY to zero.	0.0 to 3000.0s	5.0s
P 6	Motor Rated Current	The motor full-load current stated on the nameplate.	Mode dependent	-
P 7	Control Base Frequency	The output frequency at which maximum voltage is reached.	25.0 to 240.0Hz	-
P 8	JOG Frequency	The output frequency for Jog moves.	-100.0 to 100.0%	12.0%
P 9	Run Stop Mode	Decel : The motor speed is reduced to zero at a rate set by DECEL Time (P5). A 2 second pulse is applied at end of ramp Coast : The motor freewheels to a stop Injection : On a stop command, the motor volts are rapidly reduced at constant frequency. A low frequency braking current is then applied until the motor speed is almost zero. This is followed by a timed DC pulse to hold the motor shaft.	0=Decel 1=Coast 2=Injection	0
P 11	V/F Shape	Output V to F characteristic.  The graph shows Output Volts on the y-axis (0 to 100%) and Frequency on the x-axis (0 to f _B). A dashed horizontal line at 100% output voltage extends to the right. A solid line starts at the origin and rises linearly to the 100% output voltage at frequency f _B . From f _B to a higher frequency f _B , the output voltage remains constant at 100%, forming a horizontal line. This region is labeled 'CONSTANT POWER RANGE'. The region from the origin to f _B is labeled 'LINEAR'. The region from f _B to f _B is labeled 'Fan / Pump'.	0=Linear 1=Fan/Pump	0

Table 4-1 Parameter Definitions Continued

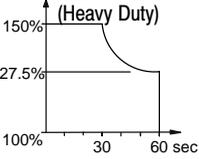
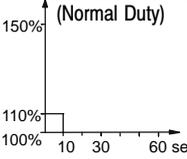
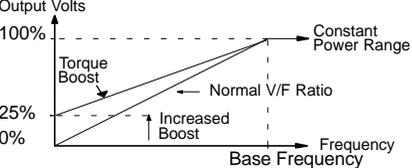
Display	Parameter	Description	Range	Factory Setting
P 12	Heavy/Normal Duty	<p>% of Rated Motor Current (Heavy Duty)</p>  <p>% of Rated Motor Current (Normal Duty)</p>  <p>Heavy Duty: Inverse time allows 150% overload for 30s, then ramps back the current limit to 105% over a 10s period. At a lower load, the overload area remains the same, e.g. at 127.5% load for 60s - after 60s has expired, the output of the inverse time function is ramped back over a 10s period from 150% as before.</p> <p>Normal Duty: the current limit is set to 110% motor current, inverse time delay is set to 10seconds.</p> <p>Note: When P11 is changed from Fan to Linear, P12 is set to 0 (Heavy). When P11 is changed from Linear to Fan, P12 is set to 1 (Normal) P12 can be changed independently.</p>	0=Heavy 1=Normal	0
P 13	Torque Boost	<p>Allows the control to produce greater starting torque for high friction loads. It increases the motor volts above the selected V/F characteristic at the lower end of the speed range 0.00 to 25.00% 5.00%</p> 	0.00 to 25.00%	5.00%
P 99	Password	<p>A password may be set to prohibit unauthorized adjustment of parameters. When P99 is set to non-zero you will be required to match this value before parameters can be adjusted.</p>	0000 – FFFF	0000
<p>Parameters P301 to P308 are visible in the PAR menu when Application 3 is selected in parameter P1. Factory setting vaies with application selected.</p>				
P 301	Preset 1	User-adjustable speed preset set by potentiometer	-100.00 to 100.00	-
P 302	Preset 2	User-adjustable speed preset	-100.00 to 100.00	-
P 303	Preset 3	User-adjustable speed preset	-100.00 to 100.00	-
P 304	Preset 4	User-adjustable speed preset	-100.00 to 100.00	-
P 305	Preset 5	User-adjustable speed preset	-100.00 to 100.00	-

Table 4-1 Parameter Definitions Continued

Display	Parameter	Description	Range	Factory Setting
P 306	Preset 6	User-adjustable speed preset	-100.00 to 100.00	-
P 307	Preset 7	User-adjustable speed preset	-100.00 to 100.00	-
P 308	Preset 8	User-adjustable speed preset	-100.00 to 100.00	-
<i>Parameters P401 to P404 are visible in the PAR menu when Application 4 is selected in parameter P1</i>				
P 401	R/L Ramp Time	The time taken to ramp the Raise/Lower output from 0.00% to 100.00% of its value	0.0 to 600.0s	10.0s
P 402	R/L MAX Value	The maximum value for the ramp output	-100.0 to 100.0%	100.0%
P 403	R/L MIN Value	The minimum value for the ramp output	-100.0 to 100.0%	0.0%
P 404	R/L Reset Value	The value the output is set to when reset is true, when DIN4 (terminal 10) is 24V in Application 4	-100.00 to 100.00%	0.00%
<i>Parameters P501 and P502 are visible in the PAR menu when Application 5 is selected in parameter P1</i>				
P 501	PI P Gain	The PI proportional gain	0.00 to 100.00	1.00
P 502	PI I Gain	The PI integral gain	0.00 to 100.00	0.00
SET::CTRL Menu				
5CL01	Control Mode	Sets the main method of motor control.	0=Volts/Hz 1=Encoderless Vector	0
5CL02	Motor Rated Speed	Rated motor full-load speed. This is the motor speed in RPM at base frequency minus full load slip.		-
5CL03	Fly-catching Enable	Enables flycatching in Volts/Hz control mode when true. Allows the drive to catch a spinning load.	0=False 1=True	0
5CL04	Slip Compensation	Slip compensation is operational when true. Reduces motor speed variations under load conditions in V/F Mode.	0=False 1=True	0
5CL05	Stabilization	Enables the stabilisation function when true. Reduces light load speed variations in V/F Mode.	0=False 1=True	1
5CL06	Decel Control Mode	NONE : No control of PWM modulation. FIXED : Output voltage is maintained, for variations in the dc link voltage. AUTOMATIC : The drive adjusts motor voltage during motor deceleration to help prevent overcurrent trips.	0=None 1=Fixed 2=Automatic	0
5CL10	Motor Rated Current	The motor full-load current stated on the nameplate.	-	-

Table 4-1 Parameter Definitions Continued

Display	Parameter	Description	Range	Factory Setting	
5CL11	Motor Poles	Sets the motor nameplate pole pairs. Speed 50Hz 60Hz Pole Set 2900 3550 2 0 1450 1750 4 1 950 1150 6 2	0=2 pole 1=4 pole 2=6 pole 3=8 pole 4=10 pole 5=12 pole	1	
5CL12	Motor Rated Volts	The motor voltage stated on the nameplate.	-	-	
5CL13	Motor Power Factor	The motor full-load power factor.	0.50 to 0.99	-	
5CL14	Motor MAG Current	The motor no-load line current, determined by autotune.	0.01 to 999.99 A	-	
5CL20	Autotune Mode	Selects the Autotune operating mode.	0= Stationary 1= Rotating	0	
5CL21	Autotune Enable	Enable/disable the autotune sequence. The autotune sequence is operational when set to true and the drive is commanded to run.	0= False 1= True	0	
SET:IN Menu					
5IP01	DIN 1 Invert	Inverts the value of the digital input signal.	0= Direct 1= Inverted	0	
5IP02	DIN 2 Invert			0	
5IP03	DIN 3 Invert			0	
5IP04	DIN 4 Invert			0	
5IP11	AIN 1 Scale		-150.0 to 150.0%	100.0%	
5IP12	AIN 1 Offset		-100.0 to 100.0%	0.00%	
5IP13	AIN 1 Type	TYPE SCALE OFFSET	0= 0-10V 1= 0-5V	0	
5IP21	AIN 2 Scale	UNPROCESSED INPUT → X → + → VALUE		-150.0 to 150.0%	0.00%
5IP22	AIN 2 Offset			0 to 100% of selected TYPE	-100.0 to 100.0%
5IP23	AIN 2 Type		0= 0-10V 1= 0-5V 2= 0-20mA 3= 4-20mA	3	

Table 4-1 Parameter Definitions Continued

Display	Parameter	Description	Range	Factory Setting
SET::OUT Menu				
50P01	AOUT 1 Source	ANALOG OUTPUT 0 NONE 1 DEMAND % 2 CURRENT % 3 PI ERROR % 4 RAISE/LOWER OUTPUT %	0= None 1= Demand 2= Current 3= PI Error 4= Raise/Lower Output	1
50P02	AOUT 1 Scale	SCALE 5 0P02 OFFSET 5 0P03 ABSOLUTE 5 0P04	-300.0 to 300.0	100.0%
50P03	AOUT 1 Offset		-300.0 to 300.0%	0.00%
50P04	AOUT 1 Absolute		0= Bipolar 1= Absolute	1
50P21	DOUT 2 Source	DIN4 / DOUT2 0 NONE 1 HEALTH 2 TRIPPED 3 RUNNING 4 AT ZERO 5 AT SPEED	INVERT (output) 5 1P04	0= None 1= Health 2= Tripped 3= Running 4= At Zero 5= At Speed
50P22	DOUT 2 Invert	Inverts the output signal. Set to 0 for applications 1 & 5.	0= Direct 1= Inverted	0
50P31	Relay Source	RELAY 0 NONE 1 HEALTH 2 TRIPPED 3 RUNNING 4 AT ZERO 5 AT SPEED	INVERT (output) 5 0P32	0= None 1= Health 2= Tripped 3= Running 4= At Zero 5= At Speed
50P32	Relay Invert	Inverts the value of the signal.	0= Direct 1= Inverted	0

Table 4-1 Parameter Definitions Continued

Display	Parameter	Description	Range	Factory Setting
SET::TRIP Menu				
5LOOP	Disable Loop	Disables lost I loop trip (4–20mA).		1
5E 3	AIN2 Overload	Disables the overload trip (Terminal 3).		0
5SELL	Disable Stall	Disables stall trip.		0
5Ot	Disable Motor Overtemp	Disables the motor thermistor trip.	0= Trip Enabled 1= Trip Disabled	1
5db r	Dynamic Brake Resistor	Disables the dynamic brake resistor trip.		1
5db S	Dynamic Brake Switch	Disables the dynamic brake switch trip.		1
5 OP	OP Station	Disables the keypad trip.		0
SET::SETP Menu				
5SE01	JOG Accel Time	As ^P 4, for Jog	0.0 to 3000.0s	1.0
5SE02	JOG DECEL Time	As ^P 5, for Jog	0.0 to 3000.0s	1.0
5SE03	Ramp Type	Selects the ramp type	0= Linear 1= S Curve	0
5SE04	S Curve Jerk	Rate of change of acceleration of the curve in units per second ³ .	0.01 to 100.00 s ³	10.00
5SE05	S Curve Continuous	When true and the S Ramp is selected, forces a smooth transition if the speed setpoint is changed when ramping. The curve is controlled by the S Ramp Jerk parameter. When false, there is an immediate transition from the old curve to the new curve.	0= False 1= True	1
5SE 11	Skip Frequency 1	The center frequency of skip band 1 in Hz.		0.0
5SE 12	Skip Frequency Band 1	The width of skip band 1 in Hz.		0.0
5SE 13	Skip Frequency 2	The center frequency of skip band 2 in Hz.		0.0
5SE 14	Skip Frequency Band 2	The width of skip band 2 in Hz.		0.0

Table 4-1 Parameter Definitions Continued

Display	Parameter	Description	Range	Factory Setting
55E21	Auto Restart Attempts	The number of restarts allowed before requiring an external fault reset.	0 to 10	0
55E22	Auto Restart Delay	Determines the delay between restart attempts for a trip included in Auto Restart Triggers. The delay starts when the error condition is cleared.	0.0 to 600.0 s	10.0
55E23	Auto Restart Triggers	Allows auto restart to be enabled for a selection of trip conditions (described in Section 5).	0x0000 to 0xFFFF	0x0000
55E24	Auto Restart Triggers+	Allows auto restart to be enabled for a selection of trip conditions (described in Section 5).	0x0000 to 0xFFFF	0x0000
55E31	Dynamic Brake Enable	Enables operation of the dynamic braking block.	0= False 1= True	1
55E32	Dynamic Brake Resistance	The value of the dynamic brake load resistance.		100
55E33	Dynamic Brake Power	The power that the load resistance may continually dissipate.	0.1 to 510.0 kW	0.1
55E34	Dynamic Brake Over-Rating	Multiplier that may be applied to Dynamic Brake Power for power overloads lasting no more than 1 second.	1 to 40	25

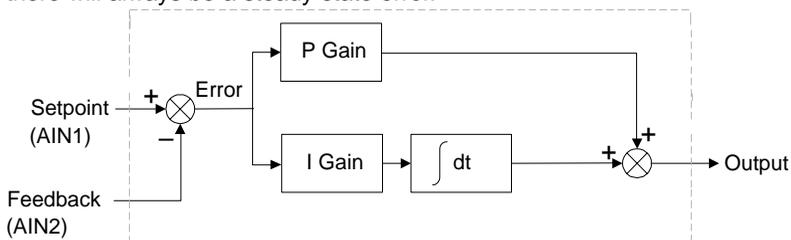
Process Control Loop Gains

Proportional Gain (P501)

This is used to adjust the basic response of the closed loop control system. The control loop error is multiplied by the Proportional Gain.

Integral Gain (P502)

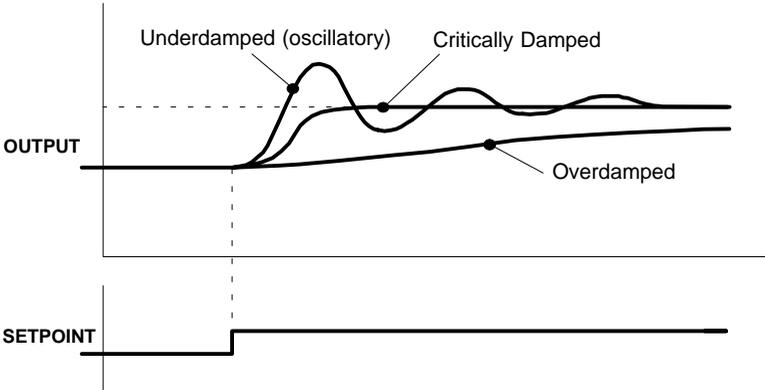
The Integral gain is used to reduce steady state error between the setpoint and feedback values of the control loop. If the integral is set to zero, then there will always be a steady state error.



Process Control Loop Gains Continued

A Method for Setting-up the Process Control Gains

The gains should be set-up so that a critically damped response is achieved for a step change in setpoint. An underdamped or oscillatory system can be thought of as having too much gain, and an overdamped system has too little.



To set up the Proportional gain, set the Integral gain to zero. Apply a step change in setpoint that is typical for the System, and observe the response. Increase the gain and repeat the test until the system becomes oscillatory. At this point, reduce the Proportional gain until the oscillations are reduced. This is the maximum value of Proportional gain to be used. If a steady state error is present, i.e. the feedback never reaches the setpoint value, the Integral gain needs to be increased. Increase the I gain and apply the step change. Monitor the output. If the output becomes oscillatory, reduce the Proportional gain slightly. This should reduce the steady state error. Increasing the Integral gain further may reduce the time to achieve zero steady state error.

The Proportional and Integral gains can now be adjusted to provide the response required for this step change.

Routine Maintenance

Periodically inspect the Inverter for build-up of dust or obstructions that may affect cooling. Remove any build-up using dry air.

Saving Your Application Data

You should write down your application settings after programming. Keep them where they will be easy to find. When a failure occurs, you may not be able to access the parameter values before returning the unit. Contact an authorized Baldor service center to arrange for the repair.

Disposal

This product contains materials which are consignable waste under the Special Waste Regulations 1996 which complies with the EC Hazardous Waste Directive – Directive 91/689/EEC. We recommend you dispose of the appropriate materials in accordance with the valid environmental control laws. The following table shows which materials can be recycled and which have to be disposed of in a special way.

Material	Recycle	Disposal
metal	yes	no
plastics material	yes	no
printed circuit board	no	yes

The printed circuit board should be disposed of in one of two ways:

1. High temperature incineration (minimum temperature 1200°C) by an incinerator authorized under parts A or B of the Environmental Protection Act.
2. Disposal in an engineered land fill site that is licensed to take aluminium electrolytic capacitors. Do not dispose of in a land fill site set aside for domestic waste.

Packaging

During transport our products are protected by suitable packaging. This is entirely environmentally compatible and should be taken for central disposal as secondary raw material.

Section 5 Troubleshooting

Trips

The trip display message is briefly displayed repeatedly (flashing) on the screen to warn of an imminent trip. Some trip conditions need time to take effect. The warning can allow you time to resolve the situation. The message will clear when you use the keypad, but after a short time will reappear until the problem is resolved, or the drive trips.

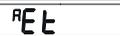
When a trip occurs, the control's power stage is immediately disabled causing the motor and load to coast to a stop. The trip is latched until action is taken to reset it. This ensures that trips due to transient conditions are captured and the control is disabled, even when the original cause of the trip is no longer present. At this time, the activated alarm is displayed on the keypad display.

Reset a Trip

All trips must be reset before the control can be re-enabled. A trip can only be reset once the trip condition is no longer active, i.e. a trip due to a heatsink over-temperature will not reset until the temperature is below the trip level. You can reset the trip as follows:

1. Press the  (STOP) key to reset the trip and clear the alarm from the display.
2. Remove and then re-apply the RUN command and the drive will run normally.

Success is indicated by either  or the Local Setpoint being displayed.

Display	Trip Message and Meaning	Possible Reason for Trip
	DC LINK HIGH The control internal dc link voltage is too high	The supply voltage is too high Trying to decelerate a large inertia load too quickly; DECEL TIME time too short The brake resistor is open circuit
	DC LINK LOW	DC LINK low trip. Supply is too low/power down
	OVERCURRENT The motor current being drawn from the control is too high	Trying to accelerate a large inertia load too quickly; ACCEL TIME time too short Trying to decelerate a large inertia load too quickly; DECEL TIME time too short Application of shock load to motor Short circuit between motor phases Short circuit between motor phase and earth Motor output cables too long or too many parallel motors connected to the control FIXED BOOST level set too high
	HEATSINK OVERTEMPERATURE Drive heatsink temperature > 100°C	The ambient air temperature is too high Poor ventilation or spacing between controls
	EXTERNAL TRIP	The external trip input is high. Check configuration to identify the source of the signal (non-standard configuration)
	LOST I LOOP (Disable: 	A current of less than 1mA is present when 4-20mA setpoint is selected – look for a wire break

Display	Trip Message and Meaning	Possible Reason for Trip
Stall	STALL (Disable:) The motor has stalled (not rotating) Drive in current limit >200 sec	Motor loading too great FIXED BOOST level set too high
AL 3	TERMINAL 3 OVERLOAD	AIN2 overload - overcurrent applied in Current mode
Rdb 7	DYNAMIC BRAKE RESISTOR External dynamic brake resistor has been overloaded	Attempting to decelerate a large inertia too quickly or too often
Rdb 5	DYNAMIC BRAKE SWITCH Internal dynamic braking switch has been overloaded	Attempting to decelerate a large inertia too quickly or too often
Rd ISP	DISPLAY (KEYPAD) Keypad has been disconnected from drive whilst drive is running in Local Control	Keypad accidentally disconnected from drive (indicated over comms, or by second keypad)
RSCI	SERIAL COMMS	COMMS TIMEOUT parameter set too short Master device failed Wiring broken Incorrect comms setup
RCEC	CONTACTOR FEEDBACK	Check connection to the terminal wired to "contactor closed" parameter in Sequencing Logic (non-standard configuration)
RSPd	SPEED FEEDBACK	SPEED ERROR > 50.00% for 10 seconds
RAOE	AMBIENT OVERTEMPERATURE	The ambient temperature in the drive is too high
R OE	MOTOR OVERTEMPERATURE The motor temperature is too high	Excessive load; motor voltage rating incorrect; FIXED BOOST level set too high; prolonged operation of the motor at low speed without forced cooling; break in motor thermistor connection
IHI	CURRENT LIMIT Software overcurrent trip	If the current exceeds 180% of stack rated current for a period of 1 second, the drive will trip. This is caused by shock loads. Remove the shock load. Other causes are: ACCEL TIME and/or FIXED BOOST set too high; DECEL TIME set too low
AL 6	TERMINAL 6 24V	Terminal 6 24V output overload (warning only)
AL SPd	LOW SPEED OVERCURRENT The motor is drawing too much current (>100%) at zero output frequency	FIXED BOOST level set too high
AL 4	TERMINAL 4 OVERLOAD	Terminal 6 24V output overload (warning only)
RSHTE	DESATURATION	Instantaneous overcurrent. Also see OVERCURRENT.
dCRP	DC LINK RIPPLE A dc link ripple alert	Supply imbalance in a 3-phase system Poor supply regulation in a 1-phase system
RdbSC	DYNAMIC BRAKE SHORT Brake resistor overcurrent	Check brake resistor value is greater than minimum allowed
ALF 27	OVERSPEED	Overspeed (> 150% base speed when in Sensorless Vector mode)

Display	Trip Message and Meaning	Possible Reason for Trip
A₅	TERMINAL 5 OVERLOAD	AOUT overload – 10mA maximum
A₉	TERMINAL 9 OVERLOAD	DIN3 overload – 20mA maximum
A₁₀	TERMINAL 10 OVERLOAD	DOUT2 overload – 50mA maximum
A_{IP}	UNKNOWN TRIP	Unknown trip
A₃₂	OTHER	"OTHER" trip is active (Trip ID 33 to 44 inclusive)
A₁	AUTOTUNE MAX SPEED LOW	During Autotune the motor is required to run at the nameplate speed of the motor. If MAX SPEED RPM limits the speed to less than this value, an error will be reported. Increase the value of MAX SPEED RPM up to the nameplate RPM of the motor (as a minimum). It may be reduced, if required, after the Autotune is complete.
A₂	AUTOTUNE MAINS VOLTS LOW	The mains input voltage is not sufficient to carry out the Autotune. Re-try when the mains has recovered.
A₃	AUTOTUNE NOT AT SPEED	The motor was unable to reach the required speed to carry out the Autotune. Possible reasons include: <ul style="list-style-type: none"> • motor shaft not free to turn • the motor data is incorrect
A₄	AUTOTUNE MAG CURRENT FAIL	It was not possible to find a suitable value of magnetising current to achieve the required operating condition for the motor. Check the motor data is correct, especially nameplate RPM and motor volts. Also check that the motor is correctly rated for the drive.
A₅	AUTOTUNE NEGATIVE SLIP FREQ	Autotune has calculated a negative slip frequency, which is not valid. Nameplate RPM may have been set to a value higher than the base speed of the motor. Check nameplate RPM, base frequency, and pole pairs are correct.
A₆	AUTOTUNE TR TOO LARGE	The calculated value of rotor time constant is too large. Check the value of nameplate RPM.
A₇	AUTOTUNE TR TOO SMALL	The calculated value of rotor time constant is too small. Check the value of nameplate RPM.
A₈	AUTOTUNE MAX RPM DATA ERROR	This error is reported when the MAX SPEED RPM is set to a value outside the range for which Autotune has gathered data. Autotune gathers data on the motor characteristics up to 30% beyond "max speed RPM". If MAX SPEED RPM is later increased beyond this range, the drive had no data for this new operating area, and so will report an error. To run the motor beyond this point it is necessary to autotune with MAX SPEED RPM set to a higher value.
A₉	AUTOTUNE MOTOR TURNING ERROR	The motor must be stationary when starting the Autotune
A_A	AUTOTUNE MOTOR STALLED ERROR	The motor must be able to rotate during Autotune
A_B	AUTOTUNE LEAKAGE L TIMEOUT	The leakage inductance measurement requires a test current to be inserted into the motor. It has not been possible to achieve the required level of current. Check that the motor is wired correctly.
CODE	Product Code Error	Switch unit off/on. If persistent, contact Baldor.

Display	Trip Message and Meaning	Possible Reason for Trip
CAL	Calibration Data Error	Switch unit off/on. If persistent, contact Baldor.
DATA	Configuration Data Error	Press the E key to accept the default configuration. If persistent, contact Baldor.

General Failures

Problem	Possible Cause	Remedy
Control will not power-up	Fuse blown	Check supply details, install correct fuse. Check Product Code and Model No.
	Faulty cabling	Check all connections are correct/secure. Check cable continuity
Control fuse keeps blowing	Faulty cabling or connections wrong	Check for problem and rectify before replacing with correct fuse
	Faulty control	Contact Eurotherm Drives
Cannot obtain power-on state	Incorrect or no supply available	Check supply details
Motor will not run at switch-on	Motor jammed	Stop the control and clear the jam
Motor runs and stops	Motor becomes jammed	Stop the control and clear the jam
	Open circuit speed reference potentiometer	Check terminal

Section 6 Specifications & Product Data

General Specifications:

Enclosure:		See Ratings table.
Mounting method:		Panel mount (all sizes) or DIN rail mounting (35mm) for size 1, 2 and 3 only.
Enclosure emissions:		Enclosure provides 15dB attenuation to radiated emissions between 30-100MHz. It must also require a security tool for opening.
Horsepower:		1/3-2 HP @ 230VAC, 1 Phase 3-5 HP @ 230VAC, 3 Phase 1/2-10 HP @ 460VAC, 3 Phase
Voltage Range:	230 VAC Models	198-264 VAC 1 ϕ 60 Hz / 198-264 VAC 1 ϕ 50 Hz
	460 VAC Models	198-264 VAC 3 ϕ 60 Hz / 198-264 VAC 3 ϕ 50 Hz 342-506 VAC 3 ϕ 60 Hz / 342-506 VAC 3 ϕ 50 Hz
Input Line Impedance:		1% minimum
Service Factor:		1.0
Duty:		Continuous
Ambient Operating Temperature:		0 to +40 °C with linear derating to 50 °C (maximum).
Cooling:		Forced air included when required.
Rated Storage Temperature:		- 25 °C to +55 °C
Humidity:		10 to 85% RH @ 40 °C Non-Condensing
Altitude:		Sea level to 3300 Feet (1000 Meters) Derate 1% per 330 Feet (100 Meters) above 3300 Feet
Shock:		1G
Vibration:		0.5G at 10Hz to 60Hz
Climatic conditions:		Class 3k3, as defined by EN50178 (1998)
Safety:	Europe	EN50178 (1998), when installed inside suitable enclosure.
	North America / Canada	UL508C
	Oversvoltage Category	Category III (3 phase power), Category II (1 phase Logic power)
	Pollution Degree	Pollution Degree 2
EMC Compliance:	Immunity:	EN50082-1 (1992), EN50082-2 (1992), EN61800-3
	Radiated Emissions:	EN50081-1(1992) and EN61800-3 when mounted inside an enclosure. Control and motor cables must be screened and correctly installed with shielded couplings where they exit the enclosure. Control 0V must be connected to protective earth/ground.
Conducted Emissions:	Size 1 & 2 only	EN50081-1(1992), EN61800-3 unrestricted distribution, maximum motor cable length is 25m.
	Size 2 & 3 only	EN50081-2(1994), EN61800-3 unrestricted distribution, maximum motor cable length is 25m.

Control Specifications:

Control method:	Selectable Encoderless Vector with auto flux control or V/Hz control.
Peak Overload Capacity:	150% for 30 sec (Constant Torque); 110% for 10 sec (Variable Torque)
PWM Frequency:	0 to 240Hz (Random PWM for quiet operation 3kHz base frequency).
Output Voltage:	0 to maximum AC Volts RMS.
V/Hz Ratio:	Linear squared reduced; base frequency; min frequency limit; max frequency limit.
Torque Boost	Automatic adjustment to load or manually adjustable 0-25% of input voltage.
Brake Torque:	Optional external braking resistors available for Size 2, 3, C, D, E and F controls.
Skip Frequency:	2 zones with adjustable bandwidth.
Frequency Setting:	0-5VDC, 0-10VDC, 0-20mA, 4-20mA or digital using keypad.
Accel/Decel:	Separate Accel and Decel rates from 0-3000 seconds to maximum frequency.
Protective Features:	Inverter trip: Over voltage, over current, under voltage, heatsink over temp, motor overload, lost command.
	Stall Prevention: Adjustable stall trip time and level.
	Outputs: Analog meter output, opto isolated output, relay output.
Optional Cooling Fan	Max ambient 45 °C
	Cooling capacity 240cfm (410m3/hr) @ 200Pa
	115VAC rating 130W, 10 μ F, 16 Ω stator resistance
	230VAC rating 140W, 2.5 μ F, 62 Ω stator resistance

Keypad Display:

Display:	7 segment and custom character display.
Keys:	6 keys with tactile response.
Display Function:	Running Setting Output frequency, set speed %, DC link voltage, motor current.
	Trip Parameter values for setting and viewing. Separate message for each trip.
Remote Mount	10 feet (3m) max from control.

Specifications: Continued**Analog Inputs:**

Operating range	0-5VDC and 0-10VDC (no sign), set with parameter SIP13 (AIN1) 0-5VDC, 0-10VDC, 0-20mA and 4-20mA (no sign), set with parameter SIP23 (AIN2) 25mA maximum input current; 24VDC maximum input voltage
Input impedance	40k ohms (current input <6VDC @ 20mA)
Resolution	10 bits (1 in 1024)
Sample rate	10mseconds

Analog Outputs:

Operating range	0-10VDC (no sign); maximum rated output current 10mA with short circuit protection
Resolution	10 bits (1 in 1024)
Dynamic response	Bandwidth 15Hz

Digital Inputs:

Operating range	0-5VDC=OFF; 15-24VDC=ON (30VDC maximum)
Input impedance	6k ohms
Rated output current	20mA

Digital Outputs: DOut2 (DOut1 is reserved)

Nominal open circuit output voltage	22.95VDC (19VDC minimum)
Nominal output impedance	82 ohms
Rated output current	20mA

Relay Output:

Operating range	250VAC maximum
Maximum current	4A resistive (non-inductive)
Sample rate	10mseconds

Ratings

Catalog Number	Size	Encl * Ⓜ	Input		Output Ratings							
					Constant Torque				Variable Torque			
			V	PH	HP	kW	IC	IP	HP	kW	IC	IP
ZD37D8A1F5-COD	1	Ⓜ	230	1	0.33	0.25	1.5	2.3				
ZD37D8A2F2-COD	1	Ⓜ	230	1	0.50	0.37	2.2	3.3				
ZD37D8A03-COD	1	Ⓜ	230	1	0.75	0.56	3.0	4.5				
ZD37D8A04-COD	1	Ⓜ	230	1	1	0.75	4.0	6.0				
ZD37D8A07-COD	2	Ⓜ	230	1	2	1.5	7.0	10.5				
ZD37D2A10-CRD	3	Ⓜ	230	3	3	2.2	10.5	15.8				
ZD37D2A16-CRD	3	Ⓜ	230	3	5	3.7	16.5	24.8				
ZD37D2A22-ERD	C	Ⓜ	230	3	7.5	5.5	22	33	10	7.4	28	30.8
ZD37D2A28-ERD	C	Ⓜ	230	3	10	7.4	28	42	15	11.1	42	46.2
ZD37D2A42-ERD	D	Ⓜ	230	3	15	11.1	42	63	20	14.9	54	59
ZD37D2A54-ERD	D	Ⓜ	230	3	20	15	54	81	25	18.6	68	74.8
ZD37D2A68-ERD	D	Ⓜ	230	3	25	19	68	102				
ZD37D2A80-ERD	E	Ⓜ	230	3	30	22	80	120	40	30	104	114.4
ZD37D2A104-CRD1	F	Ⓜ	230	3	40	30	104	156	50	37	130	143
ZD37D2A130-CRD1	F	Ⓜ	230	3	50	37	130	195	60	45	154	169.4
ZD37D2A154-CRD1	F	Ⓜ	230	3	60	45	154	231				
ZD37D4A1F5-CRD	2	Ⓜ	460	3	0.50	0.37	1.5	2.3				
ZD37D4A02-CRD	2	Ⓜ	460	3	0.75	0.56	2.0	3.0				
ZD37D4A2F5-CRD	2	Ⓜ	460	3	1	0.75	2.5	3.8				
ZD37D4A4F5-CRD	2	Ⓜ	460	3	2	1.5	4.5	6.8				
ZD37D4A5F5-CRD	2	Ⓜ	460	3	3	2.2	5.5	8.3				
ZD37D4A09-CRD	3	Ⓜ	460	3	5	3.7	9	13.5				
ZD37D4A12-CRD	3	Ⓜ	460	3	7.5	5.5	12	18				
ZD37D4A16-CRD	3	Ⓜ	460	3	10	7.4	16	24				
ZD37D4A23-ERD	C	Ⓜ	460	3	15	11.1	23	34.5	20	15	31	34.1
ZD37D4A27-ERD	C	Ⓜ	460	3	20	15	27	40.5	25	18	34	37.4
ZD37D4A31-ERD	D	Ⓜ	460	3	20	15	31	46.5	25	19	38	41.8
ZD37D4A38-ERD	D	Ⓜ	460	3	25	19	38	57.0	30	22	45	49.5
ZD37D4A45-ERD	D	Ⓜ	460	3	30	22	45	67.5	40	30	59	64.9
ZD37D4A52-ERD	D	Ⓜ	460	3	40	30	52	78	50	37	65	71.5
ZD37D4A59-ERD	E	Ⓜ	460	3	40	30	59	88.5	50	37	73	80.3
ZD37D4A73-ERD	E	Ⓜ	460	3	50	37	73	109.5	60	45	87	95.7
ZD37D4A87-ERD	E	Ⓜ	460	3	60	45	87	130.5	75	56	105	115.5
ZD37D4A105-CRD1	F	Ⓜ	460	3	75	56	105	157.5	100	75	125	137.5
ZD37D4A125-CRD1	F	Ⓜ	460	3	100	75	125	187.5	125	93	156	171.6
ZD37D4A156-CRD1	F	Ⓜ	460	3	125	93	156	234	150	112	180	198.0
ZD37D4A180-CRD1	F	Ⓜ	460	3	150	112	180	270				

V=Volts; PH=Phase; HP=Horsepower; kW=KWatts; IC=Continuous Current; IP=Peak Current.

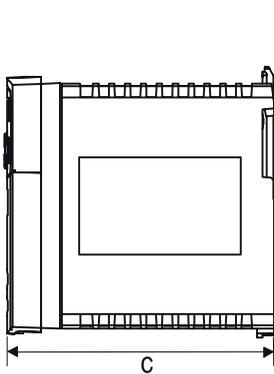
* Enclosure Types - Ⓜ & Ⓜ - IP20; Ⓜ - IP20/40

Tightening Torque Specifications

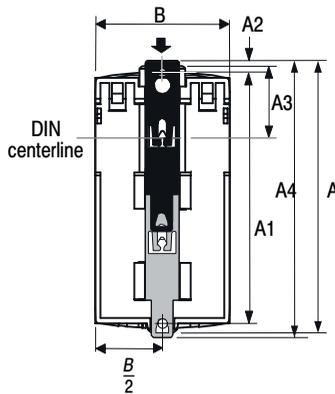
Catalog Number	Size	Tightening Torque							
		L1, L2, L3, M1, M2, M3 and DC		Earth		DBR		TH1A, TH1B & Fan	
		lb-in	Nm	lb-in	Nm	lb-in	Nm	lb-in	Nm
ZD37D8A1F5-COD	1								
ZD37D8A2F2-COD	1								
ZD37D8A03-COD	1								
ZD37D8A04-COD	1								
ZD37D8A07-COD	2								
ZD37D2A10-CRD	3								
ZD37D2A16-CRD	3								
ZD37D2A22-ERD	C	12	1.4	28	3	12	1.4		
ZD37D2A28-ERD	C	12	1.4	28	3	12	1.4		
ZD37D2A42-ERD	D	35	7	44	5	35	4		
ZD37D2A54-ERD	D	35	7	44	5	35	4		
ZD37D2A68-ERD	D	35	7	44	5	35	4		
ZD37D2A80-ERD	E	62	7	70	8	62	7		
ZD37D2A104-CRD1	F	177	20	130	15	16	1.8		
ZD37D2A1130-CRD1	F	177	20	130	15	16	1.8		
ZD37D2A1154-CRD1	F	177	20	130	15	16	1.8		
ZD37D4A1F5-CRD	2								
ZD37D4A02-CRD	2								
ZD37D4A2F5-CRD	2								
ZD37D4A4F5-CRD	2								
ZD37D4A5F5-CRD	2								
ZD37D4A09-CRD	3								
ZD37D4A12-CRD	3								
ZD37D4A16-CRD	3								
ZD37D4A23-ERD	C	12	1.4	28	3	12	1.4		
ZD37D4A27-ERD	C	12	1.4	28	3	12	1.4		
ZD37D4A31-ERD	D	35	4	44	5	35	4		
ZD37D4A38-ERD	D	35	4	44	5	35	4		
ZD37D4A45-ERD	D	35	4	44	5	35	4		
ZD37D4A52-ERD	D	35	4	44	5	35	4		
ZD37D4A59-ERD	E	62	7	70	8	62	7		
ZD37D4A73-ERD	E	62	7	70	8	62	7		
ZD37D4A87-ERD	E	62	7	70	8	62	7		
ZD37D4A105-CRD1	F	177	20	130	15	16	1.8		
ZD37D4A125-CRD1	F	177	20	130	15	16	1.8		
ZD37D4A156-CRD1	F	177	20	130	15	16	1.8		
ZD37D4A180-CRD1	F	177	20	130	15	16	1.8		

Dimensions

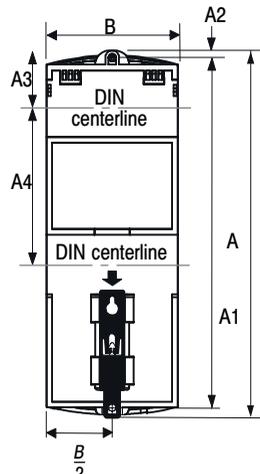
For Size 1 and 2 controls, the DIN clip can be repositioned to provide the upper mounting hole for wall mounting.



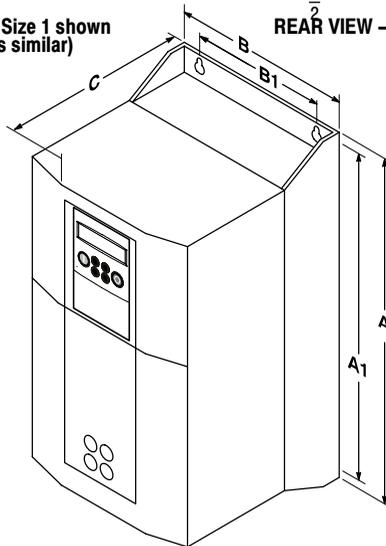
**SIDE VIEW - Size 1 shown
(Size 2 is similar)**



**REAR VIEW - Size 1 shown
(Size 2 is similar)**



REAR VIEW - Size 3



Size C, D, E, F

Size	Dimensions							Weight lbs	
	A	A1	A2	A3	A4	B	B1		C
1	5.6 (143)	5.2 (132)	0.2 (6)	1.4 (35)	5.5 (139)	2.9 (73)		5.6 (142)	1.9
2	7.9 (201)	7.4 (188)	0.24 (6.5)	1.4 (35)	7.7 (194)	2.9 (73)		6.8 (173)	3.1
3	10.2 (260)	9.5 (242)	0.2 (6)	1.5 (38)	4.4 (112)	3.8 (96)		7.9 (200)	5.9
C	14.4 (365)	13.2 (335)				7.9 (201)	5.9 (150)	8.2 (208)	20.5
D	18.5 (471)	17.3 (440)				9.92 (252)	5.9 (150)	9.7 (245)	38.2
E	26.6 (676)	24.8 (630)				10.1 (257)	5.9 (150)	12.3 (312)	72.0
F	27.6 (700)	27.6 (700)				10.1 (257)	5.9 (150)	14.0 (355)	90.4

Appendix A

Dynamic Brake

230VAC 1 & 3 Phase Controls All controls are supplied without braking resistors.

Size 1

Size 1 controls have no external dynamic brake capability.

Size 2 & 3 – 230VAC

Size 2 & 3 controls have internal brake circuit and can accept external brake resistor. The dynamic brake circuit is designed for short term stopping or braking only. It is not rated for a continuously overhauling load.

460VAC 3 Phase Controls

Size 2 and 3 – 460VAC

Size 2 and 3 460VAC controls have internal brake circuit and can accept external brake resistor. The dynamic brake circuit is designed for short term stopping or braking only. It is not rated for a continuously overhauling load.

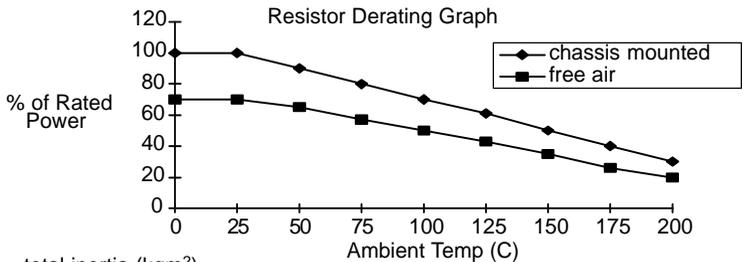
All controls are supplied without braking resistors. The dynamic brake switch terminals allow easy connection of an external resistor. These resistors should be mounted on a heatsink (enclosure panel) and covered to prevent severe burning.

Brake Calculations

Brake assemblies must be rated to absorb the peak brake power during deceleration and the average power over the complete cycle.

$$P_{pk} = \frac{0.0055 \times J \times (n_1^2 - n_2^2)}{t_b} \text{ (W)}$$

$$P_{av} = \frac{P_{pk}}{t_c} \times t_b$$



- where:
- J = total inertia (kgm²)
 - n₁ = initial speed (RPM)
 - n₂ = final speed (RPM)
 - t_b = brake time (seconds)
 - t_c = cycle time (seconds)

The minimum resistance of the combination (series/parallel resistor connections) must be as specified in Table A-1.

RGA and RGJ Assemblies

Assemblies include braking resistors completely assembled and mounted in a NEMA 1 enclosure. A listing of available resistor assemblies is provided in Table A-1. The minimum resistance “Min Ohms” shown in the table is the minimum resistor value that can be connected to the control without causing damage to the internal dynamic brake switch.

Appendix B

CE Guidelines

CE Declaration of Conformity

Baldor indicates that the products are only components and not ready for immediate or instant use within the meaning of "Safety law of appliance", "EMC Law" or "Machine directive".

The final mode of operation is defined only after installation into the user's equipment. It is the responsibility of the user to verify compliance.

The product conforms with the following standards:

DIN VDE 0160 / 05.88	Electronic equipment for use in electrical power installations
DIN VDE 0100	Erection of power installations with nominal voltages up to 1000V
DIN IEC 326 Teil 1 / 10.90	Design and use of printed boards
DIN VDE 0110Teil 1-2 / 01.89	Dimensioning of clearance and creepage distances
DIN VDE 0110Teil 20 / 08.90	Degrees of protection provided by enclosures
EN 60529 / 10.91	

EMC – Conformity and CE – Marking

The information contained herein is for your guidance only and does not guarantee that the installation will meet the requirements of the council directive 89/336/EEC.

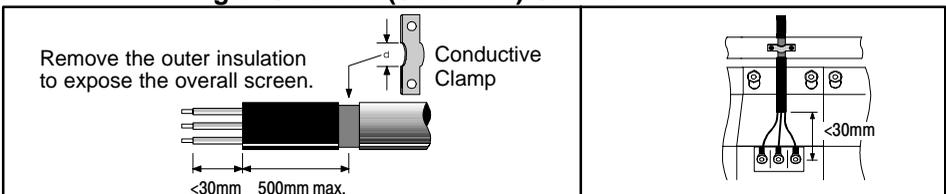
The purpose of the EEC directives is to state a minimum technical requirement common to all the member states within the European Union. In turn, these minimum technical requirements are intended to enhance the levels of safety both directly and indirectly.

Council directive 89/336/EEC relating to Electro Magnetic Compliance (EMC) indicates that it is the responsibility of the system integrator to ensure that the entire system complies with all relative directives at the time of installing into service.

Motors and controls are used as components of a system, per the EMC directive. Hence all components, installation of the components, interconnection between components, and shielding and grounding of the system as a whole determines EMC compliance.

The CE mark does not inform the purchaser which directive the product complies with. It rests upon the manufacturer or his authorized representative to ensure the item in question complies fully with all the relative directives in force at the time of installing into service, in the same way as the system integrator previously mentioned. Remember, it is the instructions of installation and use, coupled with the product, that comply with the directive.

Wiring of Shielded (Screened) Cables

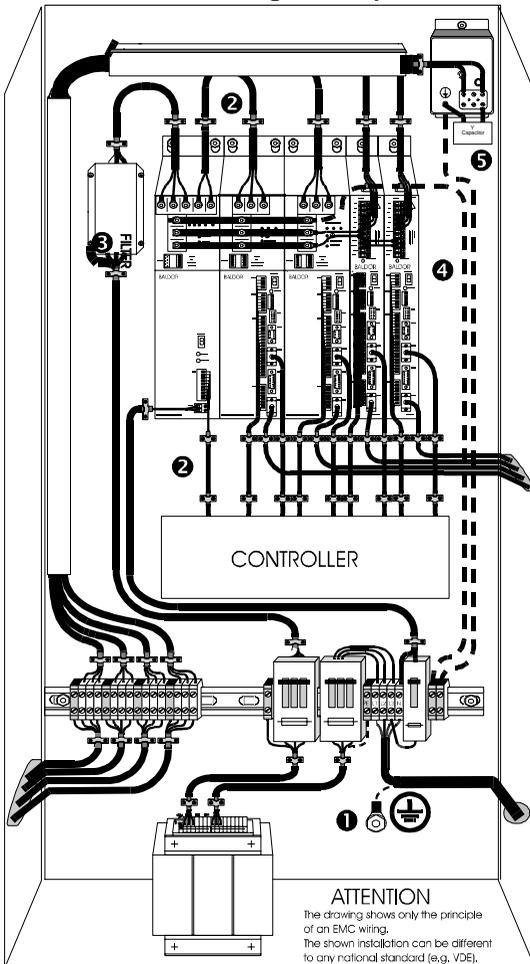


Using CE approved components will not guarantee a CE compliant system!

1. The components used in the drive, installation methods used, materials selected for interconnection of components are important.
2. The installation methods, interconnection materials, shielding, filtering and grounding of the system as a whole will determine CE compliance.
3. The responsibility of CE mark compliance rests entirely with the party who offers the end system for sale (such as an OEM or system integrator).

Baldor products which meet EMC directive requirements are indicated by a "CE" mark. A duly signed CE declaration of conformity is available from Baldor.

EMC Wiring Technique



1 CABINET

The drawing shows an electroplated zinc coated enclosure, connected to ground. This enclosure has the following advantages:
 - All parts mounted on the back plane are connected to ground.
 - All shield (screen) connections are connected to ground.
 Within the cabinet there should be a spatial separation between power wiring (motor and AC power cables) and control wiring.

2 SCREEN CONNECTIONS

All connections between components must use shielded cables. The cable shields must be connected to the enclosure. Use conductive clamps to ensure good ground connection. With this technique, a good ground shield can be achieved.

3 EMC - FILTER

The EMI or main filter should be mounted next to the power supply (here BPS). For the connection to and from the main filter screened cables should be used. The cable screens should be connected to screen clamps on both sides. (Exception: Analog Command Signal).

4 Grounding (Earth)

For safety reasons (VDE0160), all BALDOR components must be connected to ground with a separate wire. The diameter of the wire must be at minimum AWG#6 (10mm²). Ground connections (dashed lines) must be made from the central ground to the regen resistor enclosure and from the central ground to the Shared Power Supply.

5 Y-CAPACITOR

The connection of the regeneration resistor can cause RFI (radio frequency interference) to be very high. To minimize RFI, a Y-capacitor is used. The capacitor should only be connected between the dynamic brake resistor housing and terminal pin R1 (lead from Lin).

Recommendation:
 0,1µF / 250VAC Type: PME265
 BALDOR-Ordering-No.: ASR27104

EMC Installation Instructions

To ensure electromagnetic compatibility (EMC), the following installation instructions should be completed. These steps help to reduce interference. Consider the following:

- Grounding of all system elements to a central ground point
- Shielding of all cables and signal wires
- Filtering of power lines

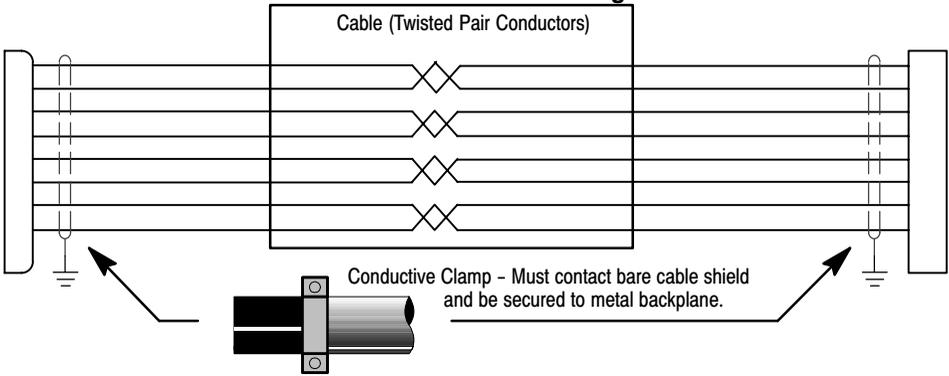
A proper enclosure should have the following characteristics:

- A) All metal conducting parts of the enclosure must be electrically connected to the back plane. These connections should be made with a grounding strap from each element to a central grounding point . ^[1]
- B) Keep the power wiring (motor and power cable) and control wiring separated. If these wires must cross, be sure they cross at 90 degrees to minimize noise due to induction.
- C) The shield connections of the signal and power cables should be connected to the screen rails or clamps. The screen rails or clamps should be conductive clamps fastened to the cabinet. ^[2]
- D) The cable to the regeneration resistor must be shielded. The shield must be connected to ground at both ends.
- E) The location of the AC mains filter has to be situated close to the drive so the AC power wires are as short as possible.
- F) Wires inside the enclosure should be placed as close as possible to conducting metal, cabinet walls and plates. It is advised to terminate unused wires to chassis ground. ^[1]
- G) To reduce ground current, use at least a 10mm² (6 AWG) solid wire for ground connections.

^[1] Grounding in general describes all metal parts which can be connected to a protective conductor, e.g. housing of cabinet, motor housing, etc. to a central ground point. This central ground point is then connected to the main plant (or building) ground.

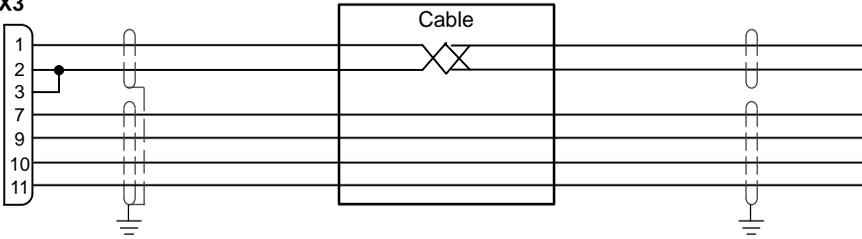
^[2] Or run as twisted pair at minimum.

Cable Screens Grounding



Input Signal Cable Grounding

Control
X3





Baldor UK Limited
 Mint Motion Centre
 Hawley Drive.
 Bristol Distribution Centre,
 Bristol, BS32 0BF
 United Kingdom
 Tel: (+44) 01454 850000

Date: 1/5/02	EC Declarations of Conformity	Ref: DE00013-000
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This is to certify that Baldors Inverter products comply with the requirements of CE Directive as described below and being one of:-

35D Family 37D Family 38D Family

When used in accordance with the guidance and instructions given in the corresponding Product Installation Manual, the above Electronic Products conform with the protection requirements of Council Directive 89/336/EEC and amended by 92/31/EEC and 93/68/EEC, Article 10 and Annex 1, relating to the EMC Directive and Manufacturers Declaration for EMC, by the application of the relevant clauses of the following standards:

<u>Standard</u>	<u>EMC Directive</u>	<u>Manufacturers Declaration</u>
BSEN 500081-1: 1992 &/or BSEN50081-2	✓	✓
(1994): 1996	✓	✓
BSEN 50082-1#: 1998	✓	✓
BSEN 50082-2#: 1995	✓	✓
BSEN 61800-3 : 1996	✓	✓
BSEN 61000-3-2: 1995	✓	✓

compliant with these immunity standards without specified EMC Filters and with the protection requirements of Council Directive 72/23/EEC (amended by 93/68/EEC) article 13 and Annex III relating to Low Voltage Equipment, by following the guidance found in the relevant clauses of the following standard:-

<u>Standard</u>	<u>Title</u>
EN50178: 1997	Electronic equipment for use in power installations

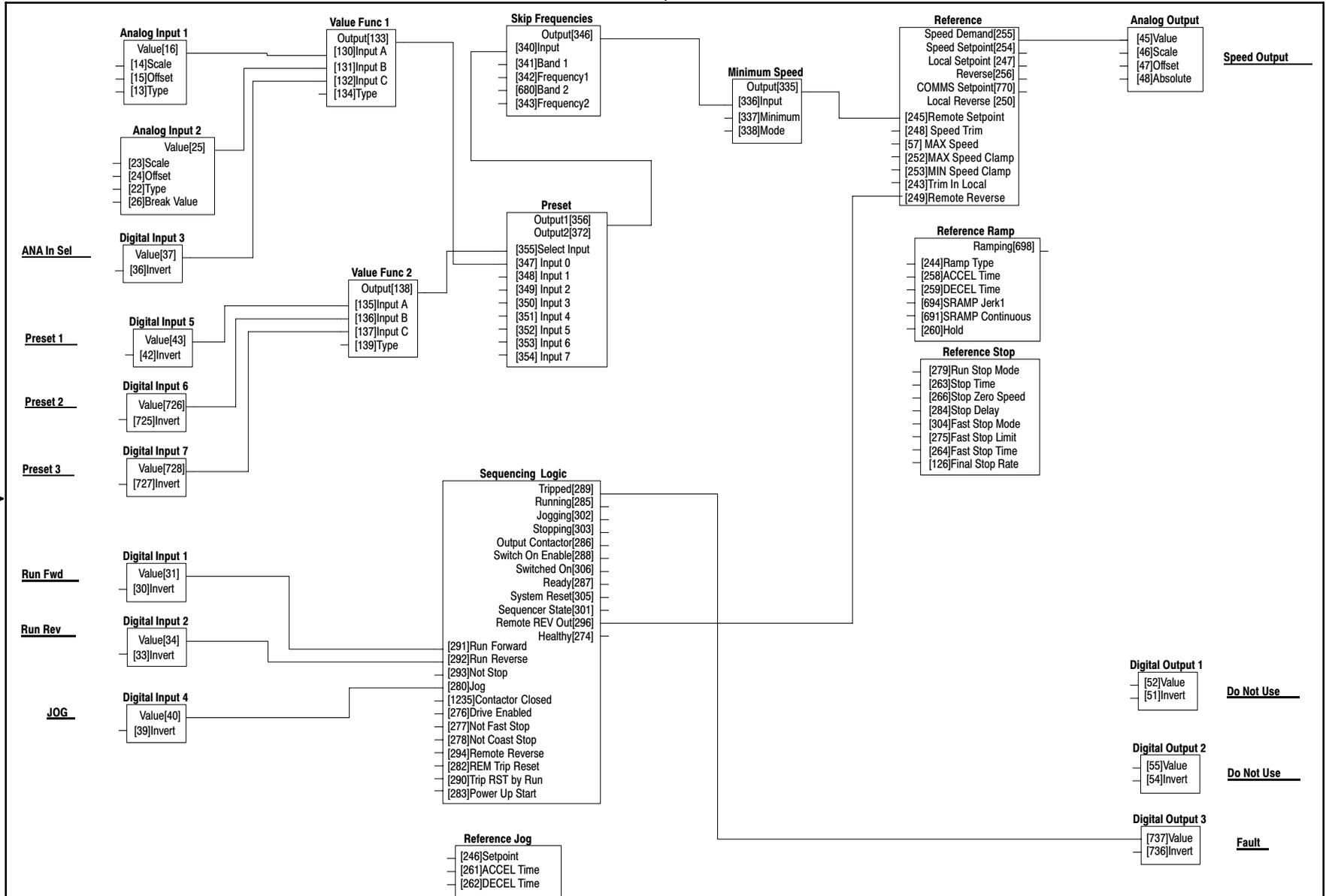
Machinery Directive

The above Electronic Products are components to be incorporated into machinery and may not be operated alone. The complete machinery or installation using this equipment may only be put in to service when the safety considerations of the Directive 89/392/EEC are fully adhered to. Particular reference should be made to EN60204-1 (Safety of Machinery – Electrical Equipment of Machines). All instructions, warnings and safety information of the Product Installation Manual must be adhered to.



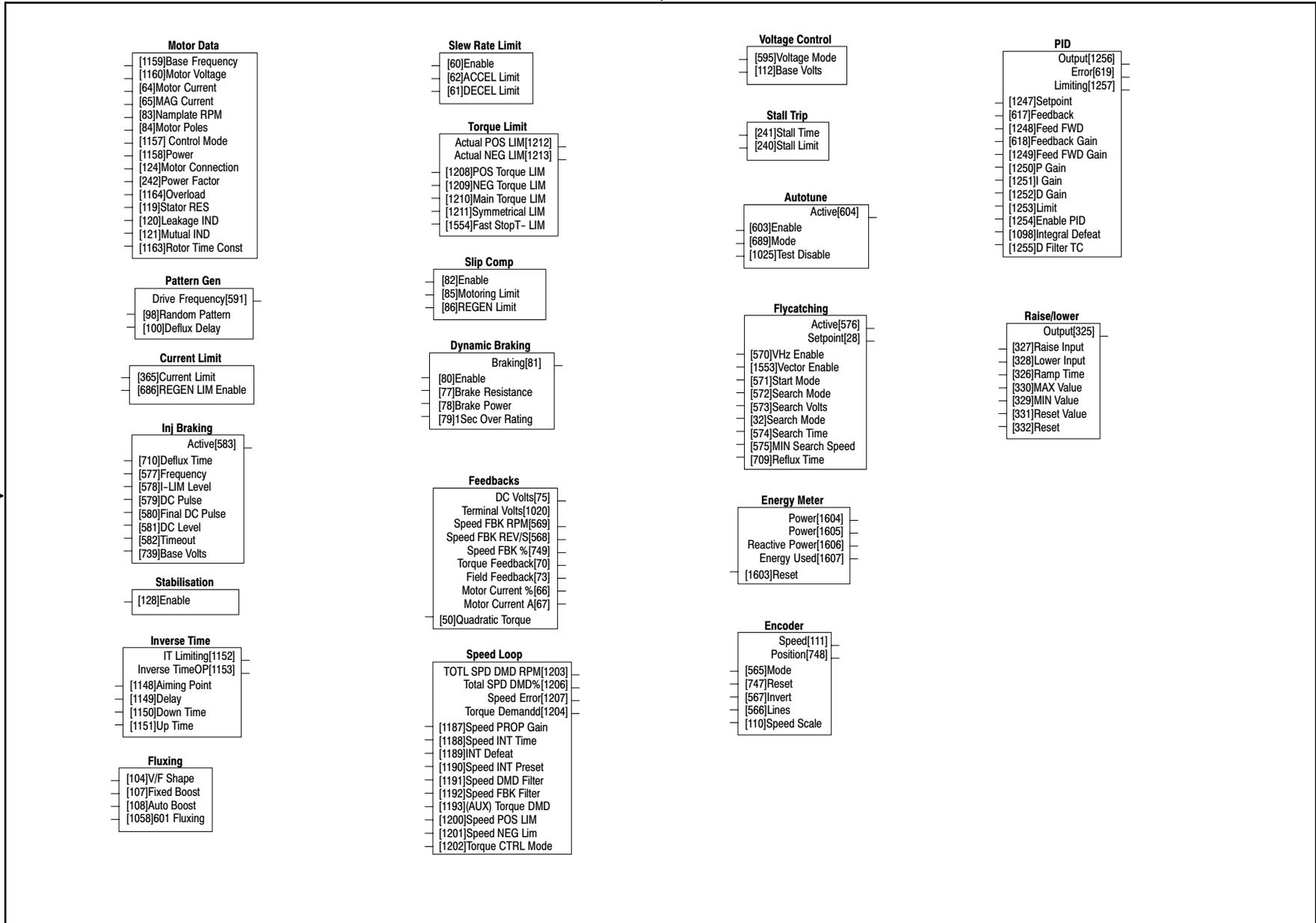
Signed:
 Dr. Gerry Boast
 Engineering Manager

Appendix C Software Block Diagrams



Baldor Macro 2: 8 Speed, 2 Wire

Important! Configurations display configurable connections and parameters only.	DWN			SIZE A	DWG. NO.	
	CHK			ISSUE	1	25 Apr 02
	APP			SCALE	SHEET	1 OF 4



Important! Configurations display configurable connections and parameters only.	DWN			SIZE A	DWG. NO.
	CHK			ISSUE	1
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					25 Apr 02
					2 OF 4

Auto Restart
 Pending[608]
 Restarting[616]
 Attempts Left[614]
 Time Left[615]
 [612]Attempts
 [613]Attempt Delay1
 [609]Triggers1
 [744]Triggers 1+

Local Control
 Remote SEQ[297]
 Remote REF[257]
 [298]Local/Remote
 [265]REF Modes
 [299]Power Up Mode
 [281]SEQ Direction

Io Trips
 Thermist State[1155]
 [760]Invert Thermist
 [234]External Trip

Trips Status
 Active Trips[4]
 Active Trips+[740]
 Warnings[5]
 Warnings+[741]
 First Trip[6]
 [231]Disable Trips
 [742]Disable Trips+

Trips History
 Trip 1 (Newest)[500]
 Trip 2[501]
 Trip 3[502]
 Trip 4[503]
 Trip 5[504]
 Trip 6[505]
 Trip 7[506]
 Trip 8[507]
 Trip 9[508]
 Trip 10(Oldest)[509]

System Port (P3)
 [102]Group ID (GID)
 [103]Unit ID (UID)

Op Station
 DISP 1 Version[230]
 DISP 2 Version[1110]

Comms Control
 COMMS SEQ[295]
 COMMS REF[270]
 COMMS Status[272]
 Comms Command[273]
 [300]Remote COMMS SEL
 [307]Remote SEQ Modes
 [308]Remote REF Modes
 [309]COMMS Timeout

Access Control
 [8]Password
 [878]Detailed Menu

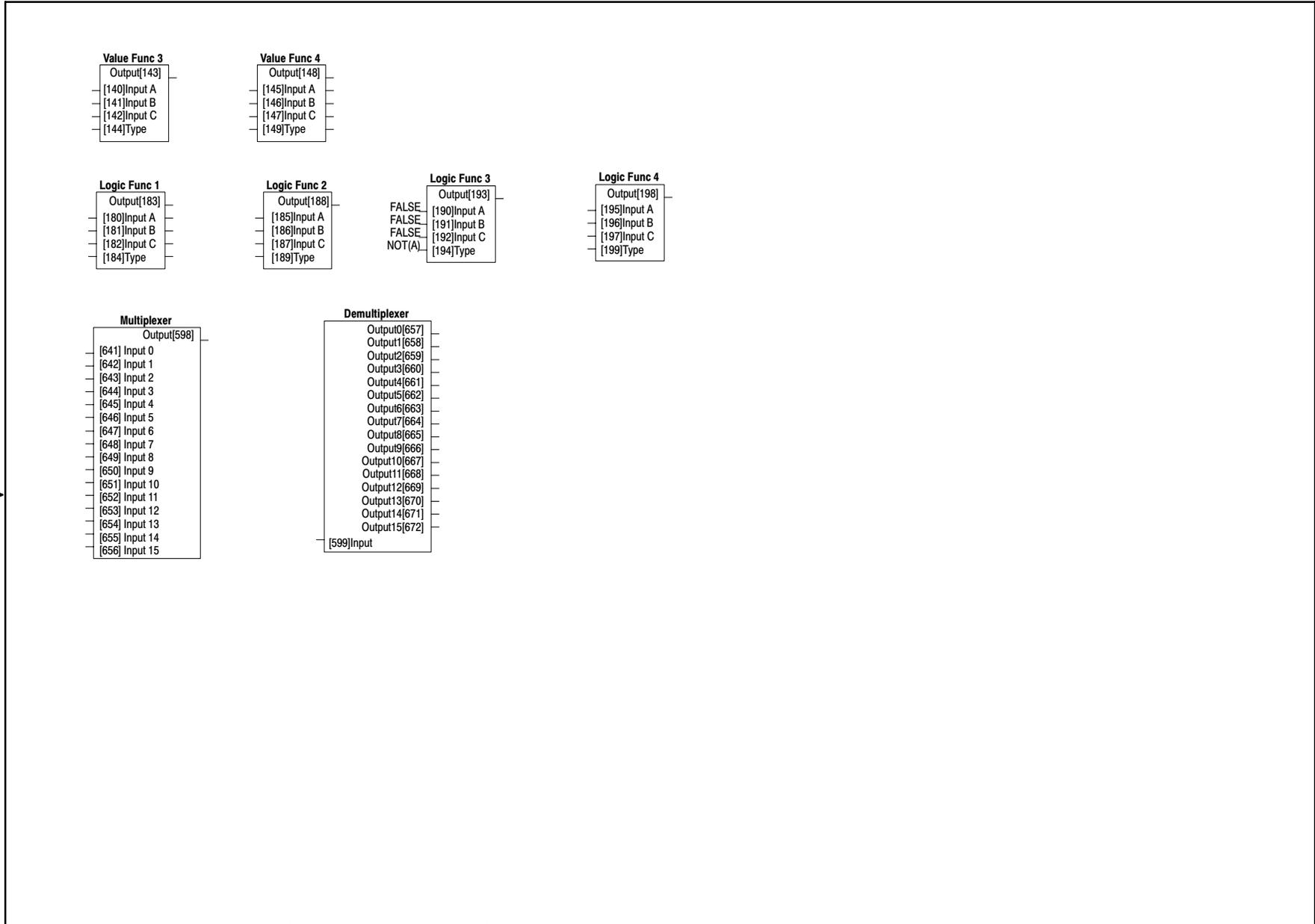
App Config
 [1091]Application
 [1092]ANOUT Source
 [1093]Relay Source
 [1094]DIGIO2 Source
 [1064]APP Lock

Zero Speed
 At Zero Speed[1233]
 [359]Hysteresis
 [357]Threshold

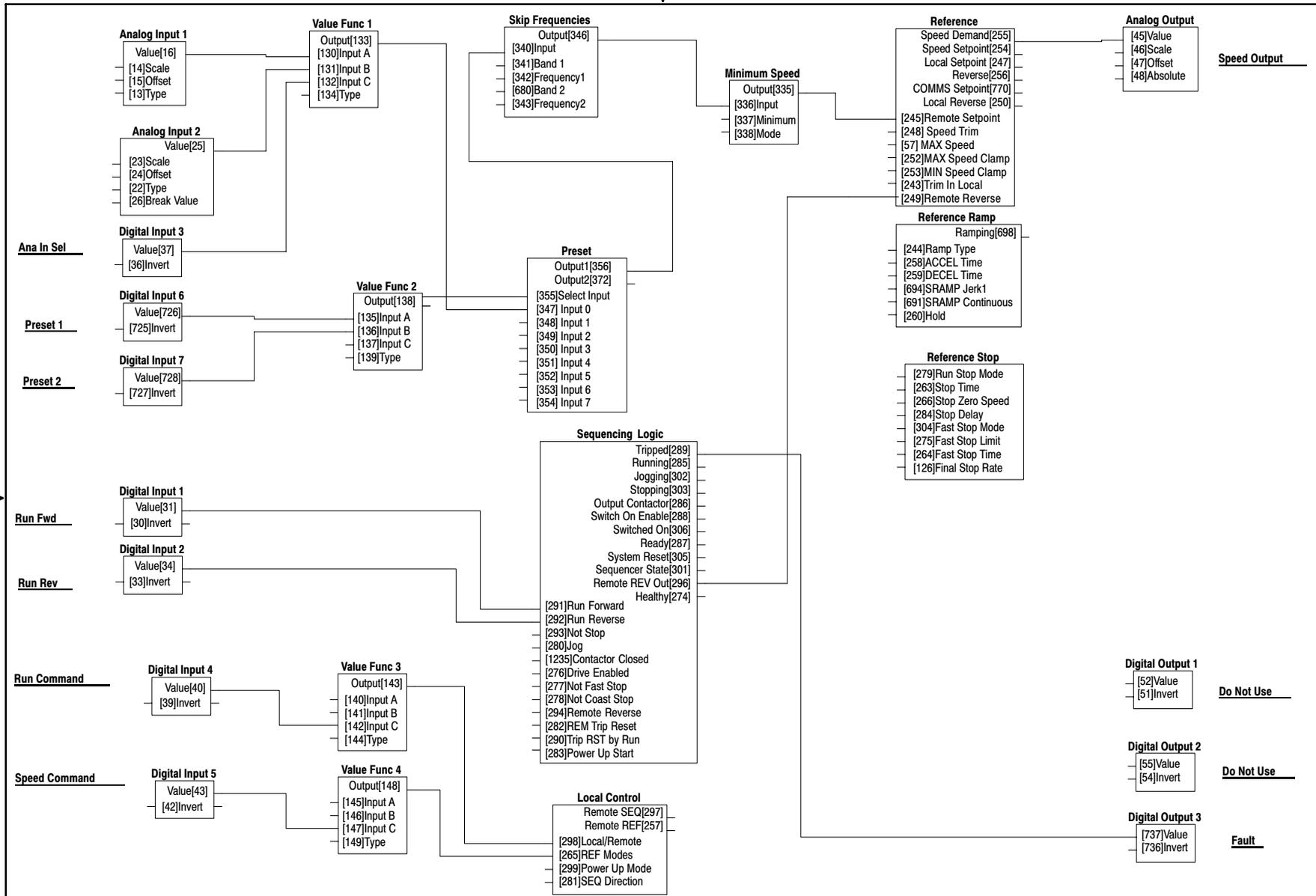
At Speed
 At Speed[1096]
 [1095]Hysteresis

At Load
 At or Above Load[622]
 [621]Level

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	CHK			ISSUE 1	25 Apr 02
	APP			SCALE	SHEET 3 OF 4

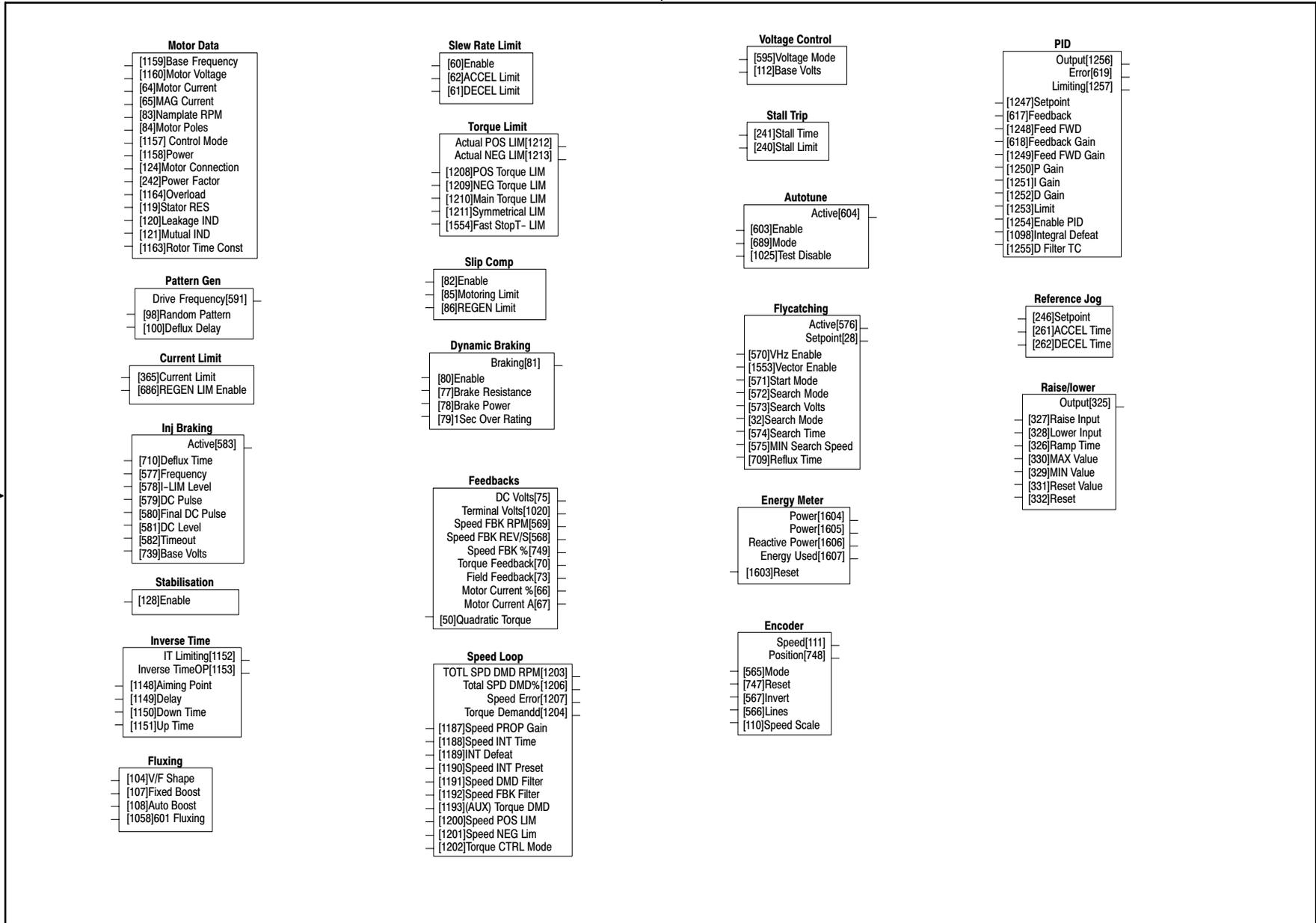


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	APP			SCALE	SHEET 4 OF 4

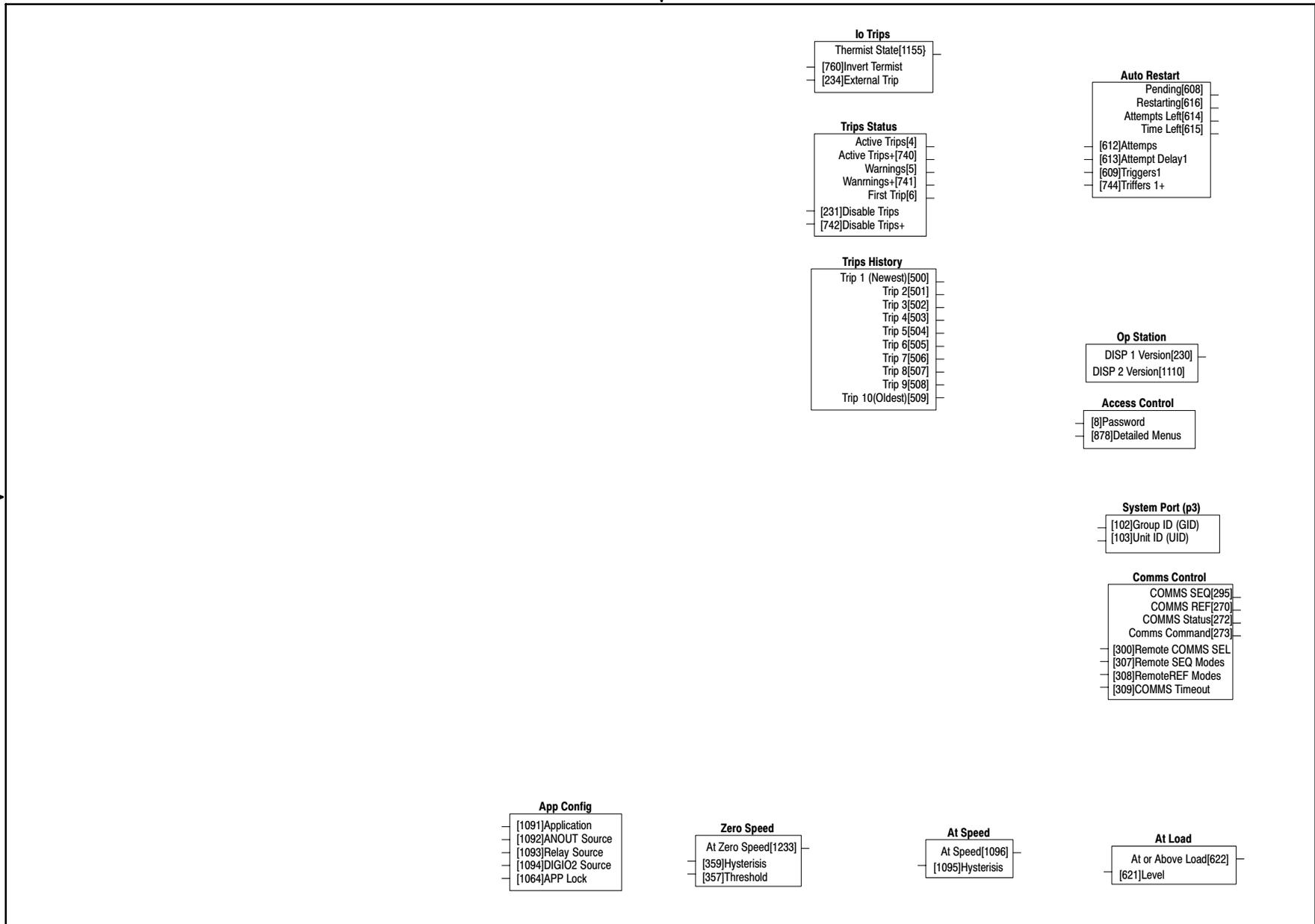


Baldor Macro 3: 3 Speed Command Select, 2 Wire

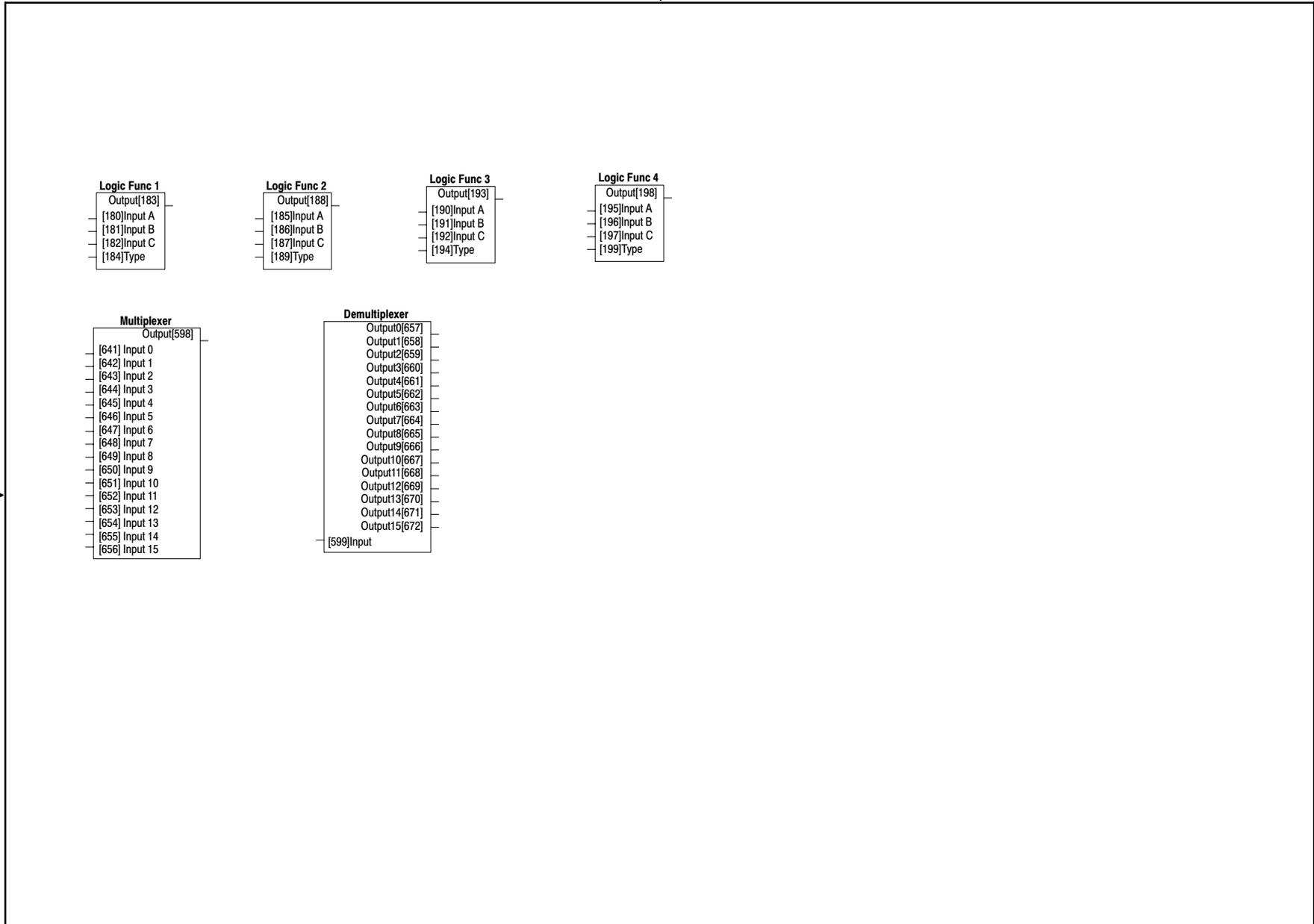
Important! Configurations display configurable connections and parameters only.	DWN			SIZE A	DWG. NO.
	CHK			ISSUE 1	25 Apr 02
	APP			SCALE	SHEET 1 OF 4



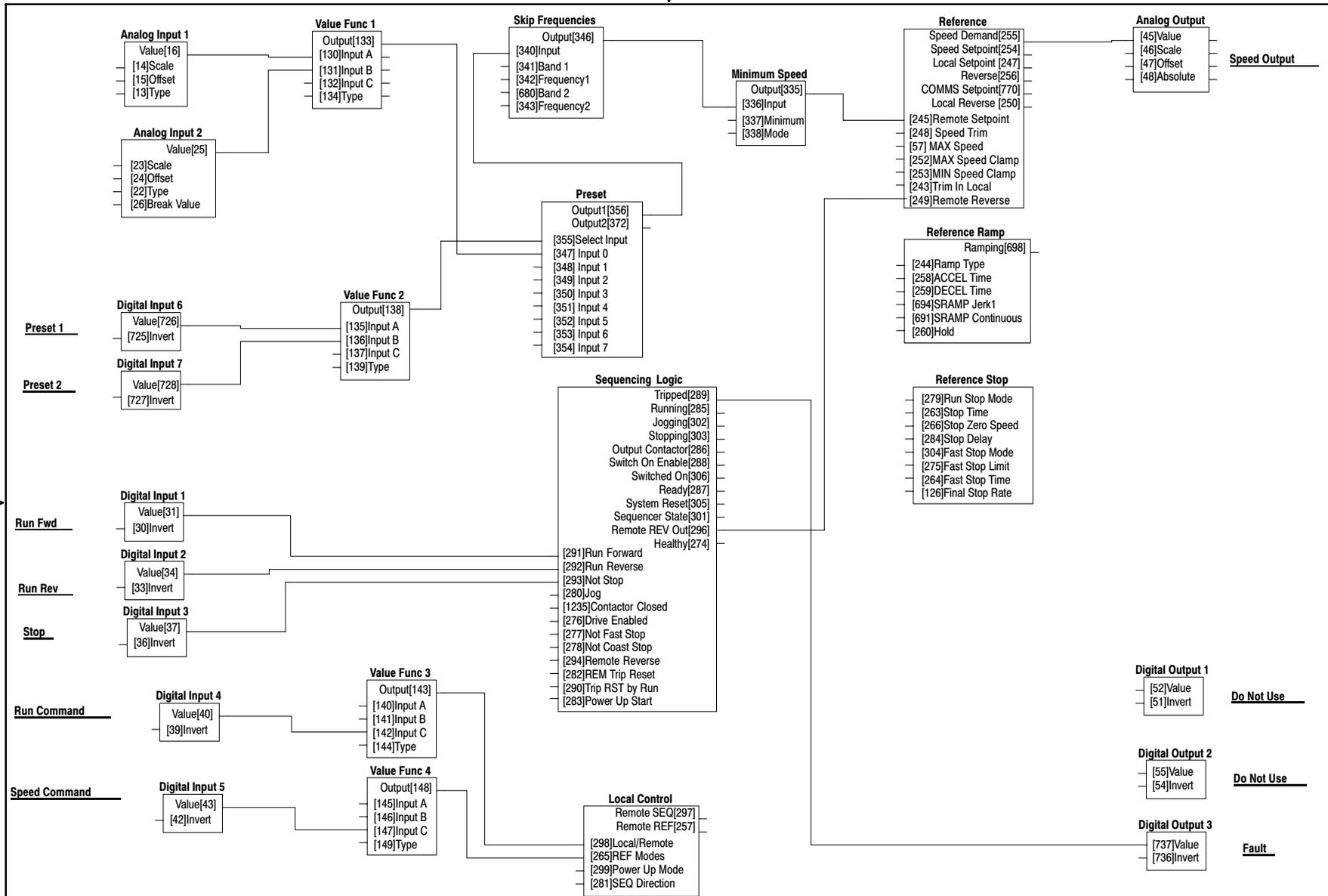
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	CHK			ISSUE 1	25 Apr 02
	APP			SCALE	SHEET 2 OF 4



Important! Configurations display configurable connections and parameters only.	DWN			SIZE A	DWG. NO.	
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	APP			SCALE	SHEET	3 OF 4

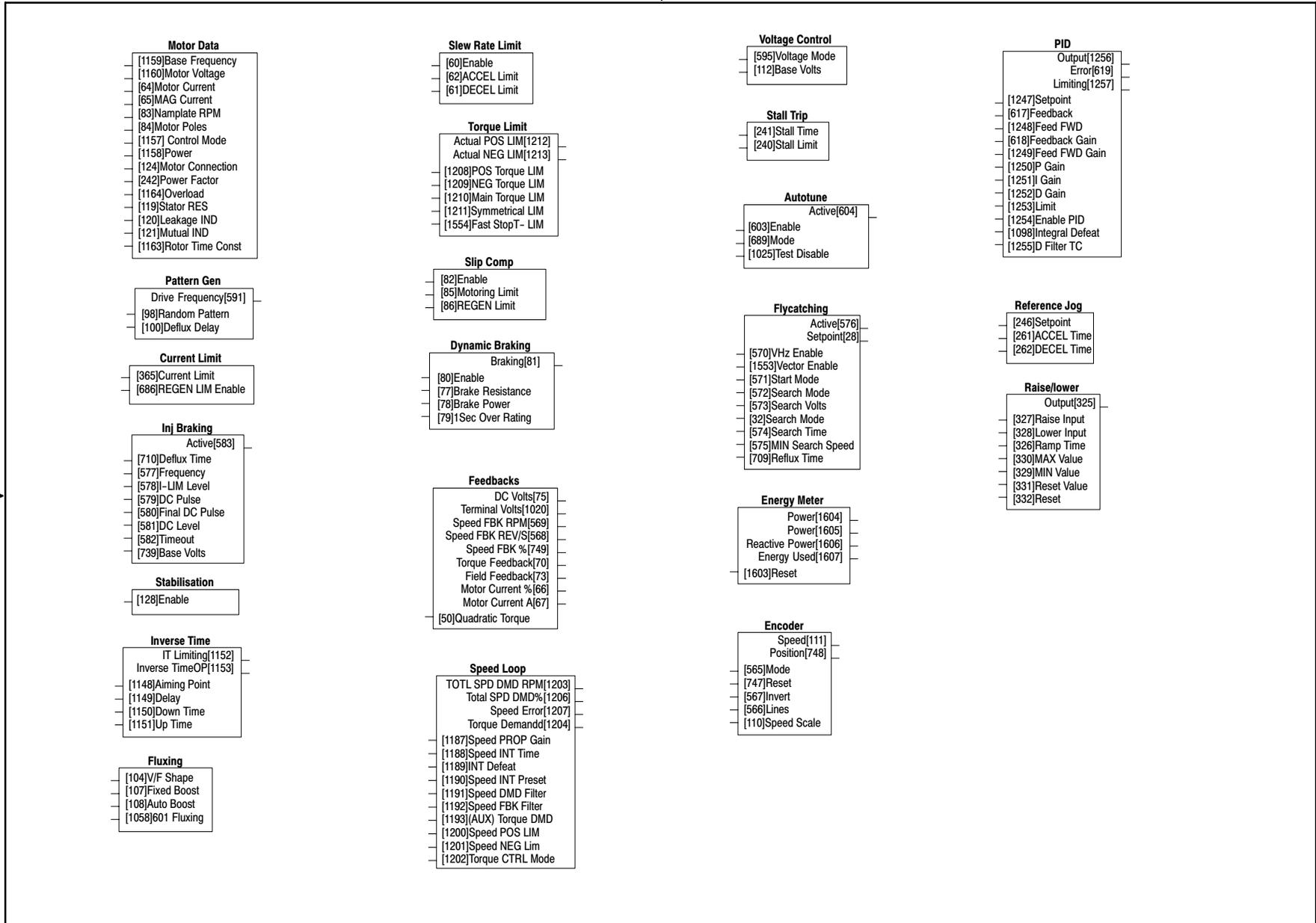


Important! Configurations display configurable connections and parameters only.	DWN			SIZE A	DWG. NO.
	CHK			ISSUE 1	25 Apr 02
	APP			SCALE	SHEET 4 OF 4

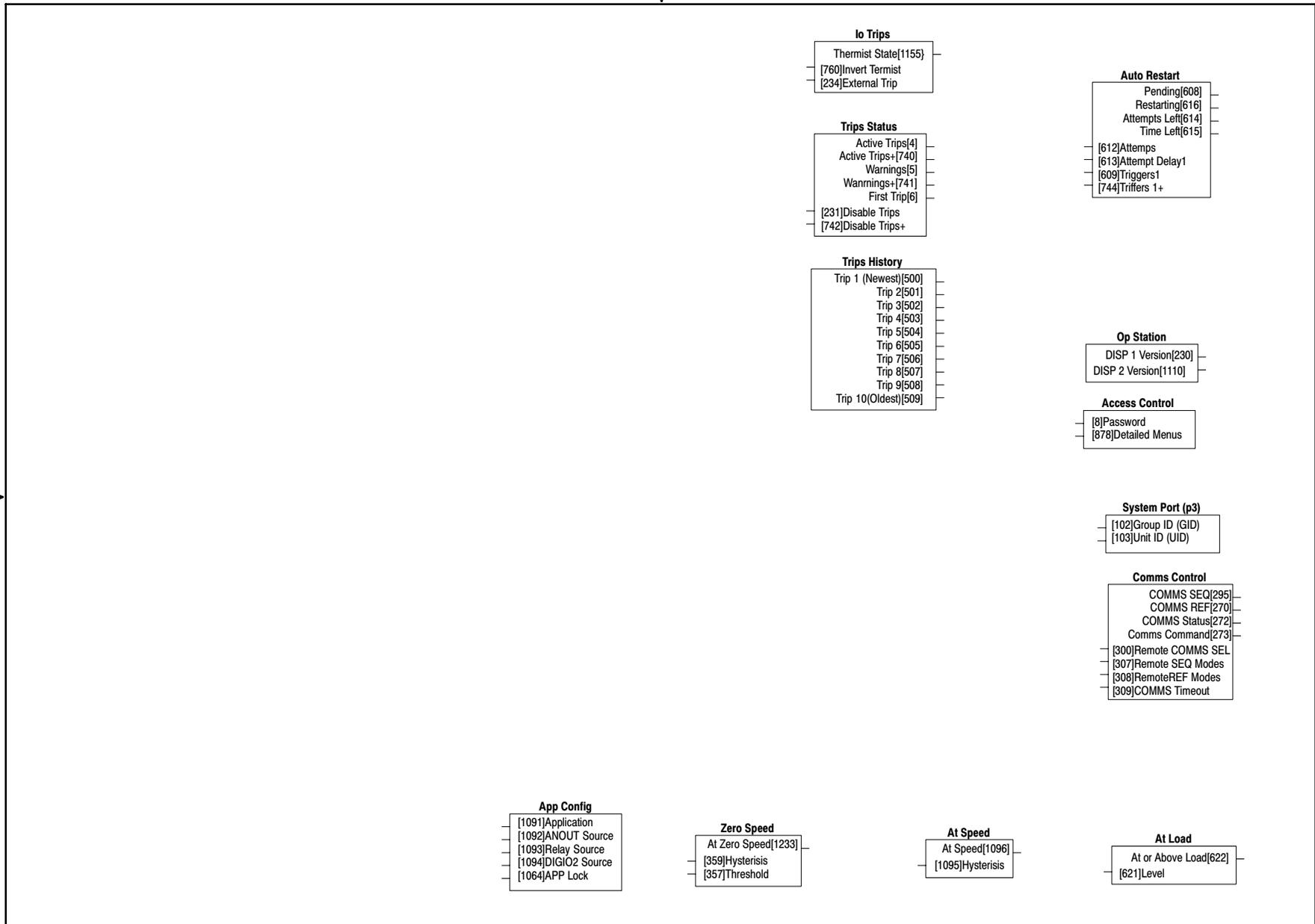


Baldor Macro 4: 3 Speed Command Select, 3 Wire

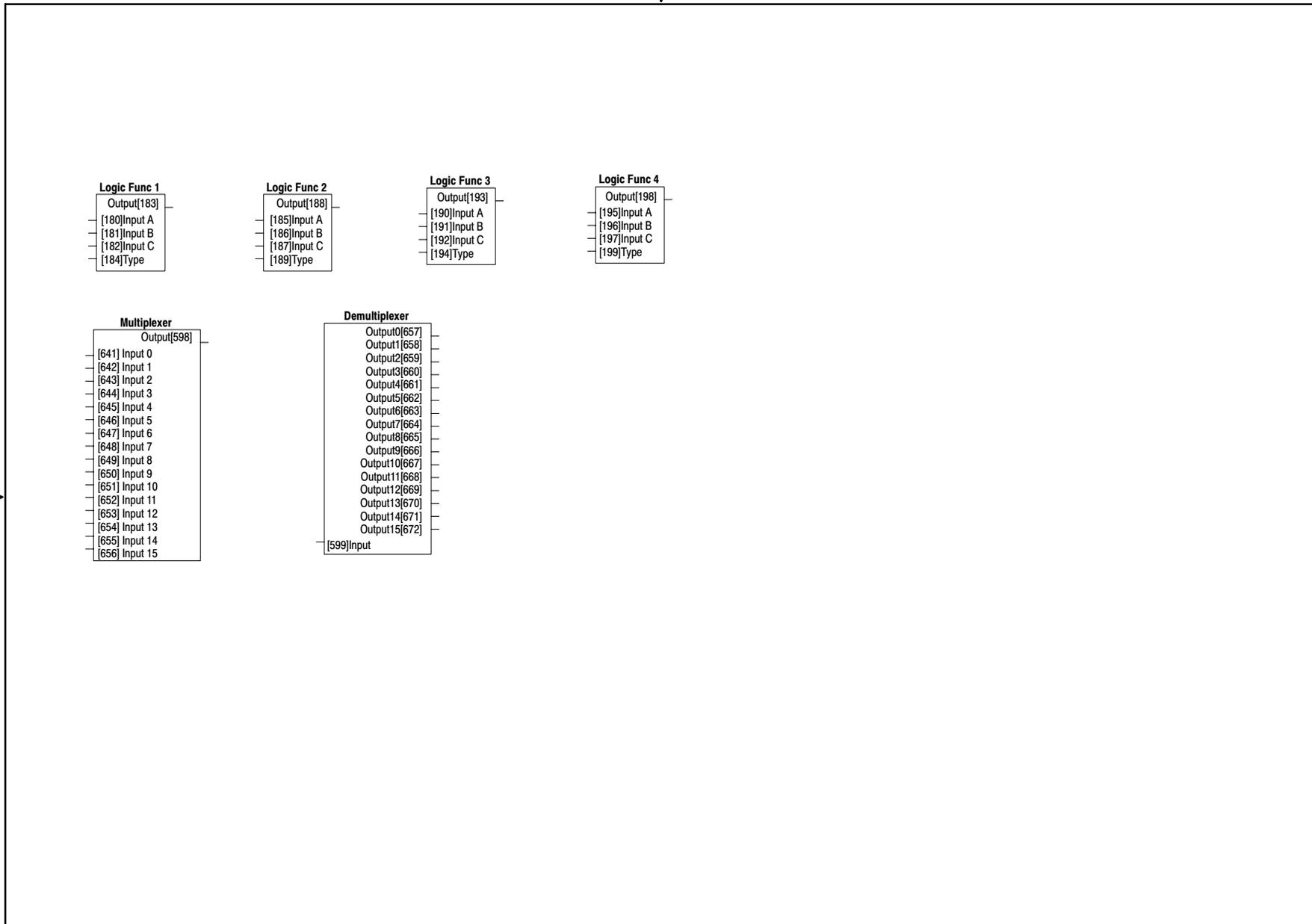
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	APP			SCALE	SHEET 1 OF 4



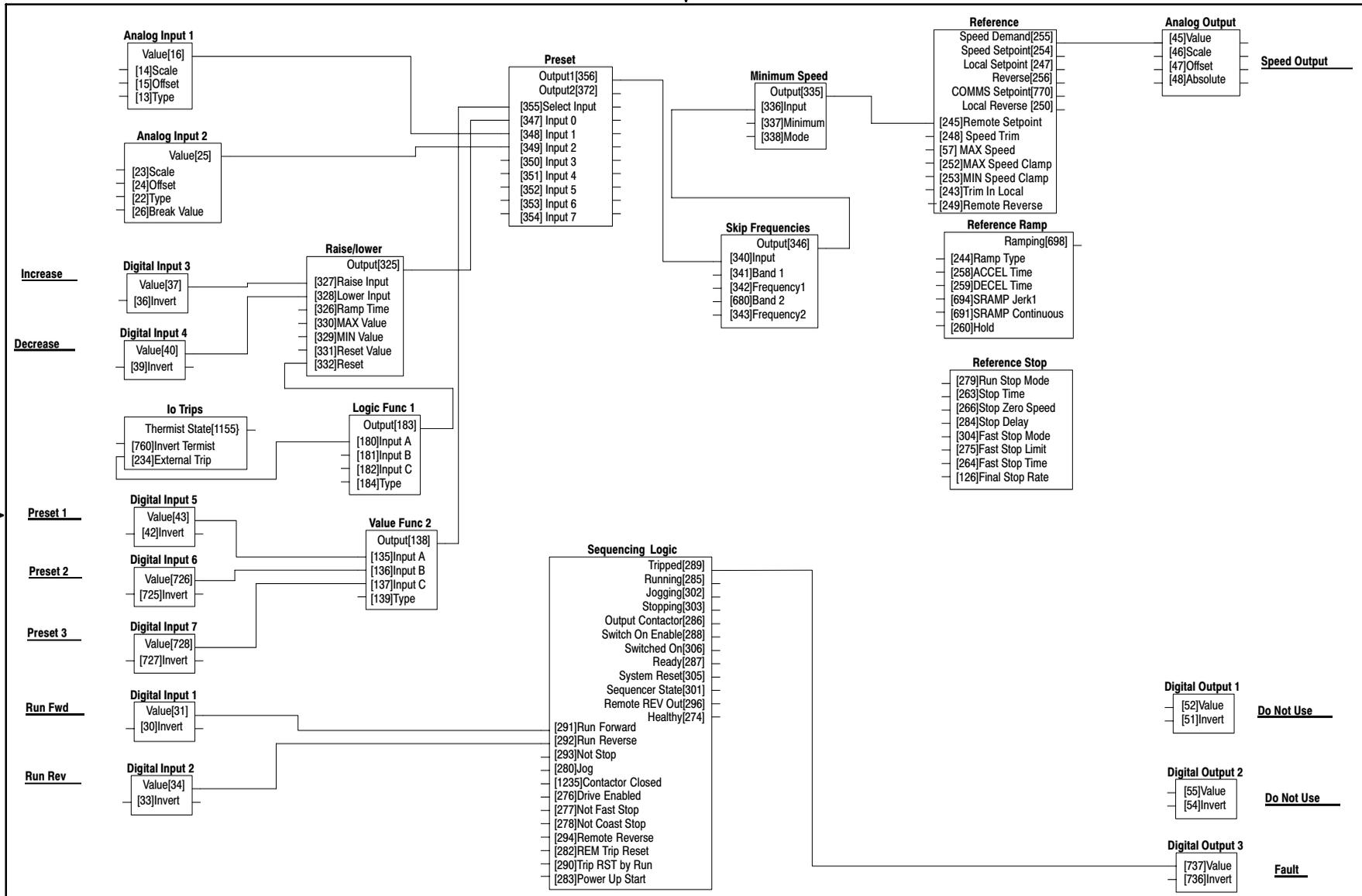
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	CHK			ISSUE	1
	APP			SCALE	SHEET
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					2 OF 4



Important! Configurations display configurable connections and parameters only.	DWN			SIZE A	DWG. NO.
	CHK			ISSUE 1	25 Apr 02
	APP			SCALE	SHEET 3 OF 4

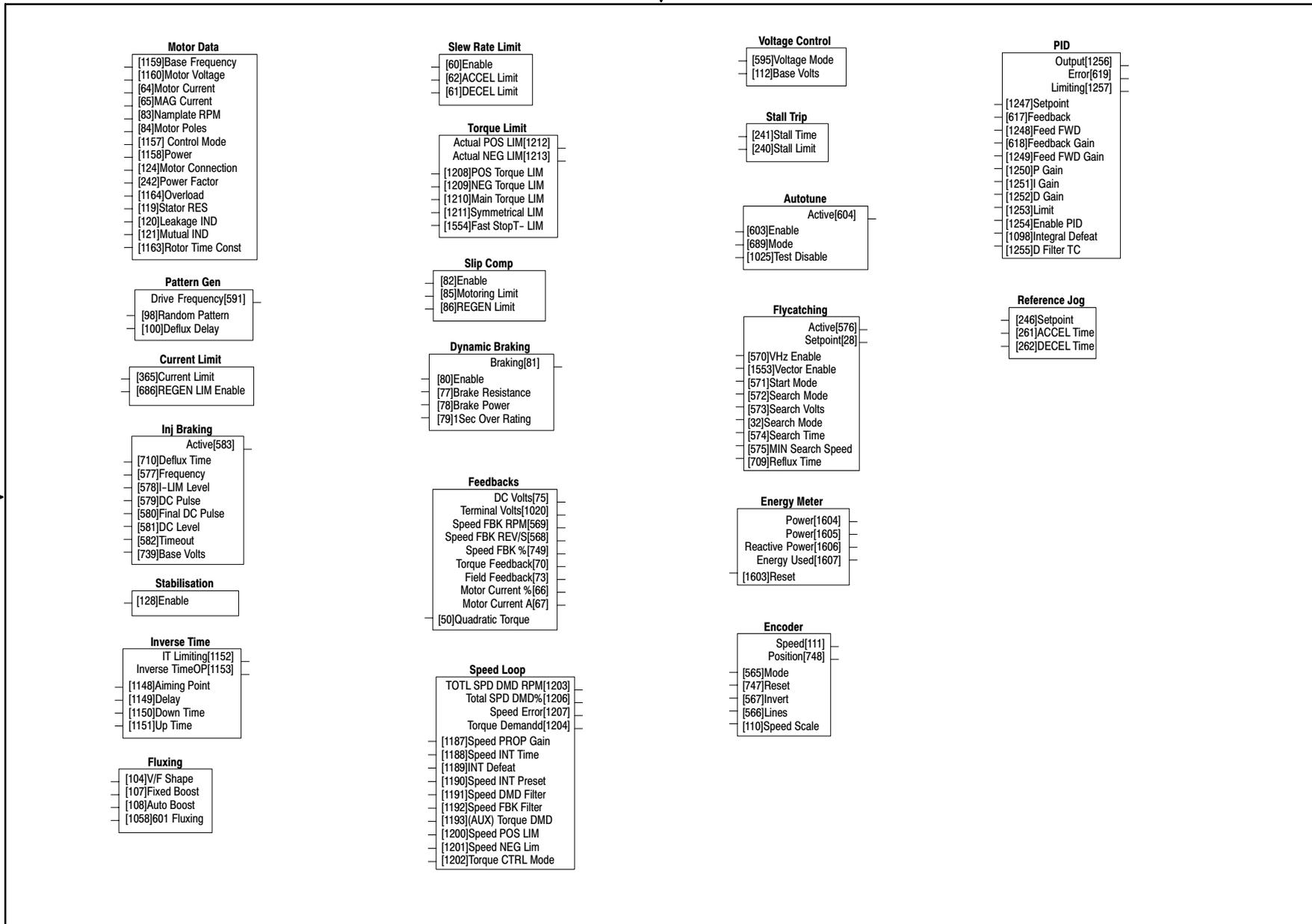


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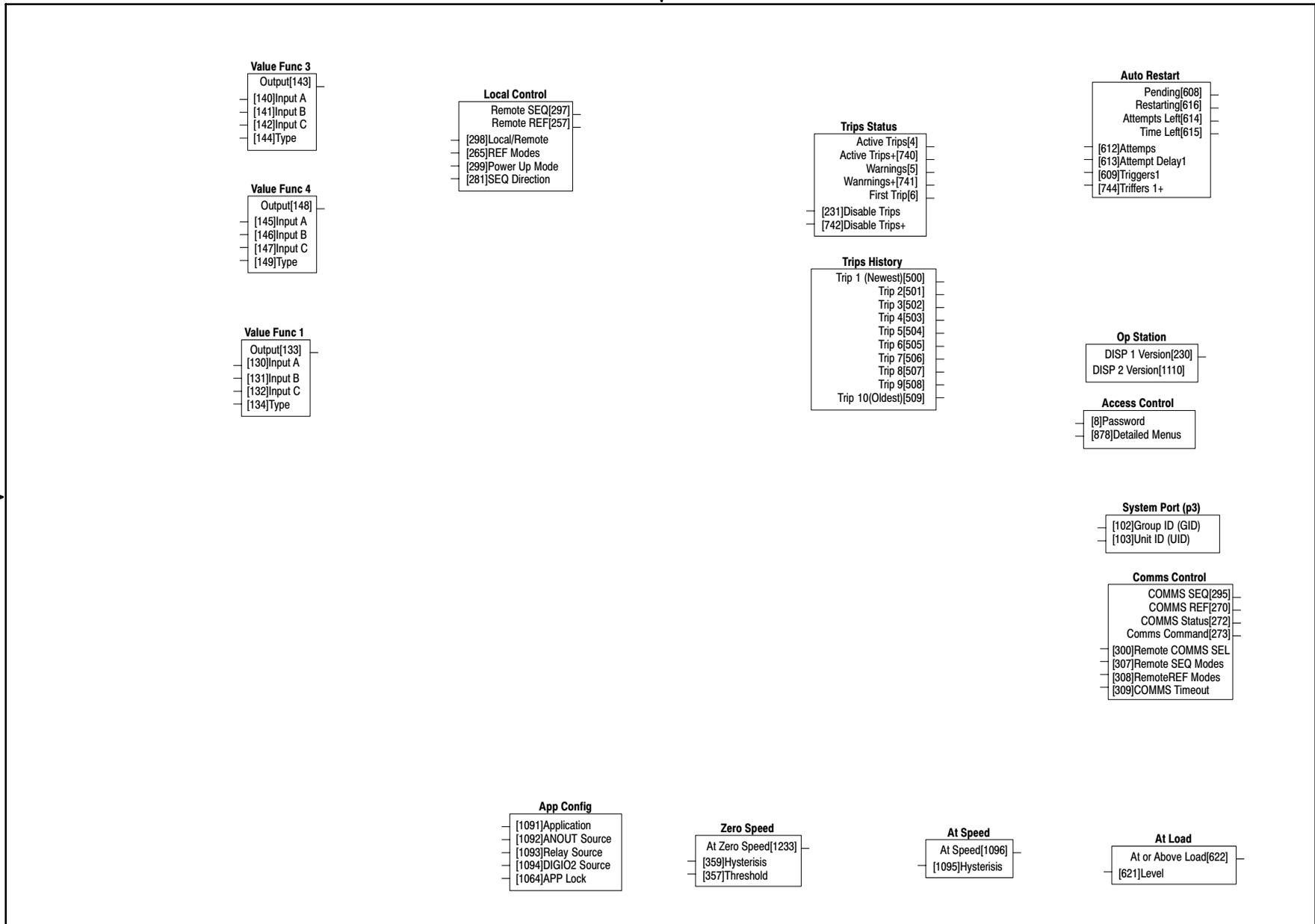


Baldor Macro 5: EPOT, 2 Wire

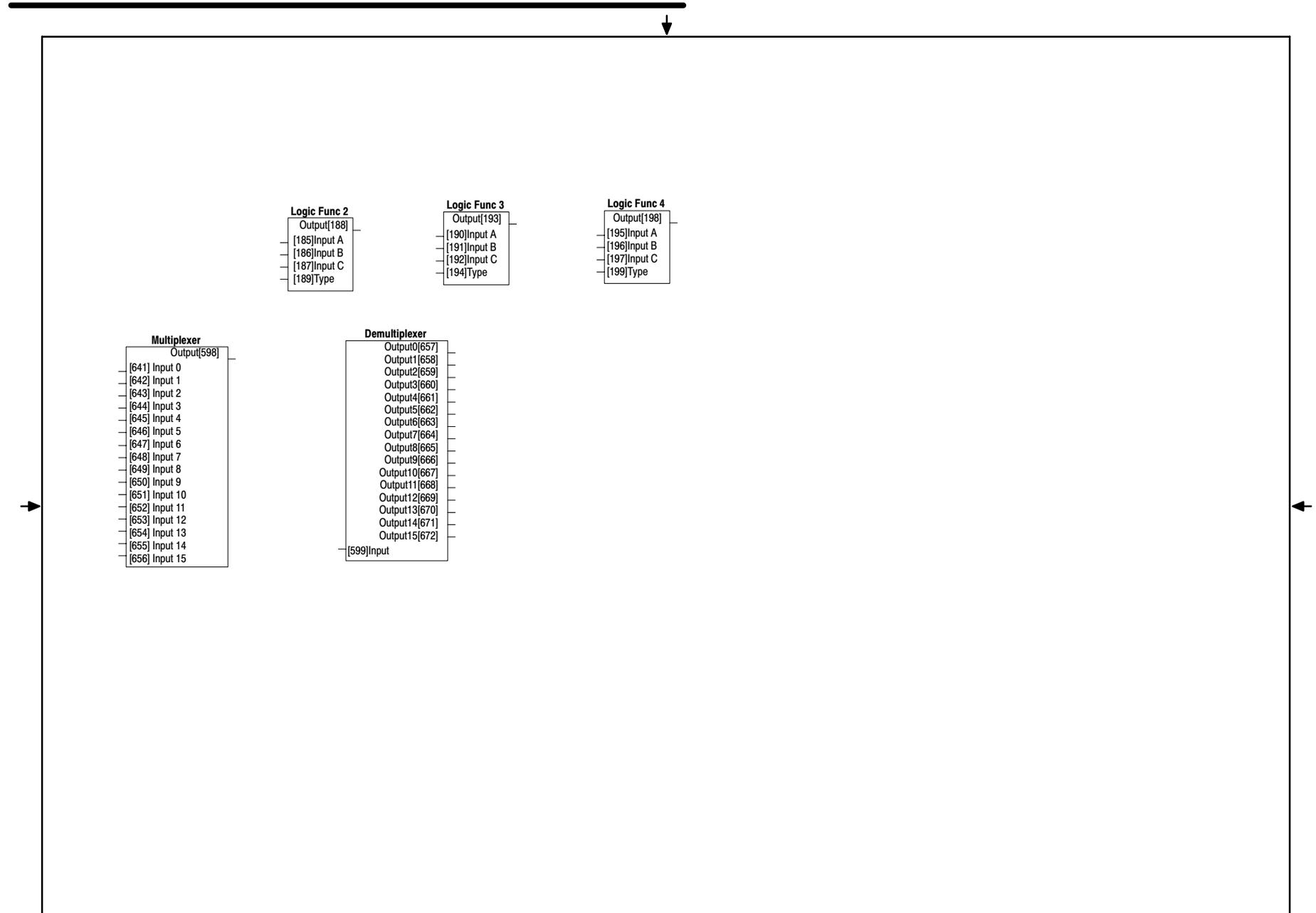
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	CHK			ISSUE 1	25 Apr 02
	APP			SCALE	SHEET 1 OF 4



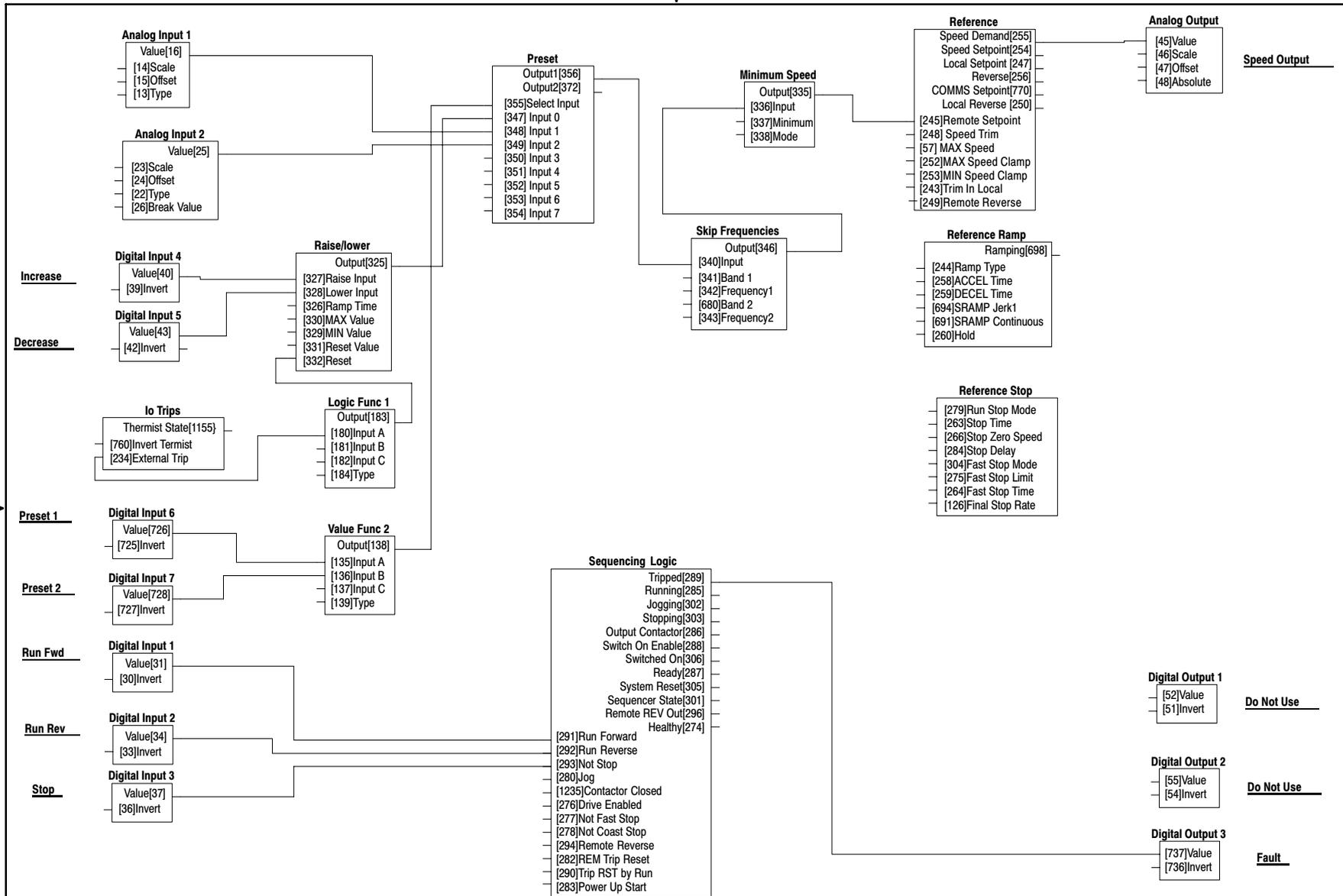
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	CHK			ISSUE 1	25 Apr 02
	APP			SCALE	SHEET 2 OF 4



Important! Configurations display configurable connections and parameters only.	DWN			SIZE A	DWG. NO.
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	APP			SCALE	SHEET 3 OF 4

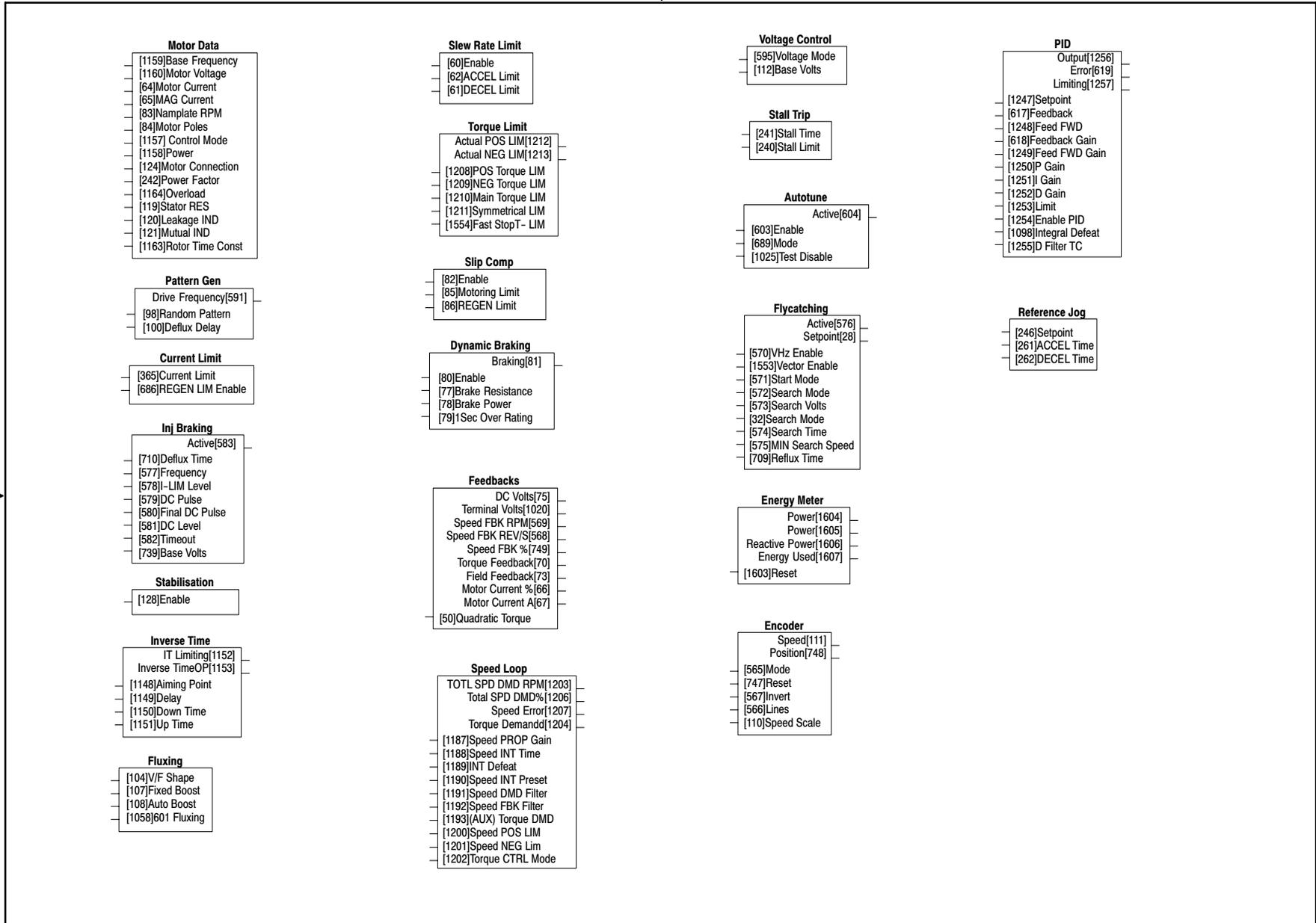


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	APP			SCALE	SHEET 4 OF 4

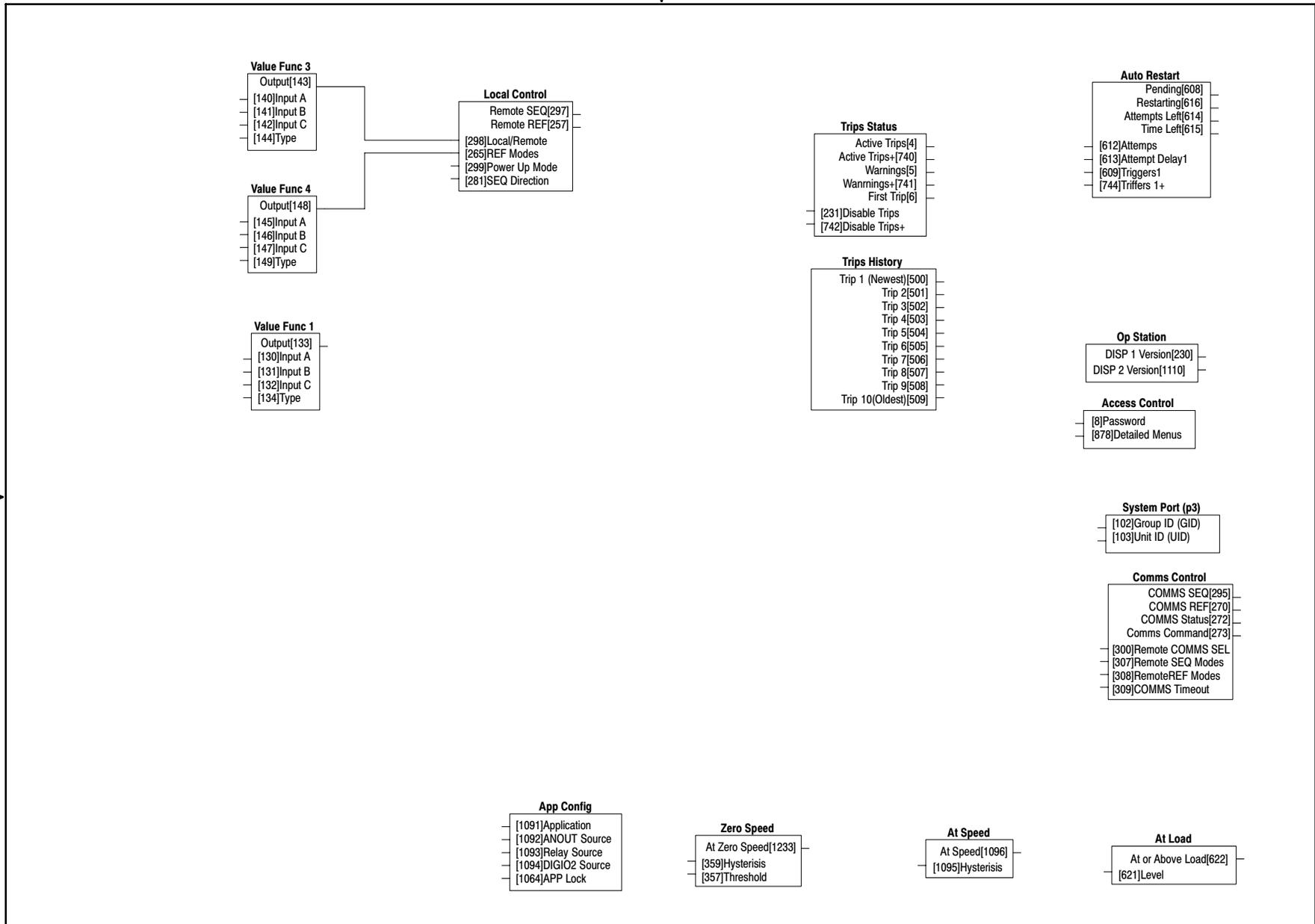


Baldor Macro 6: 8 EPOT, 3 Wire

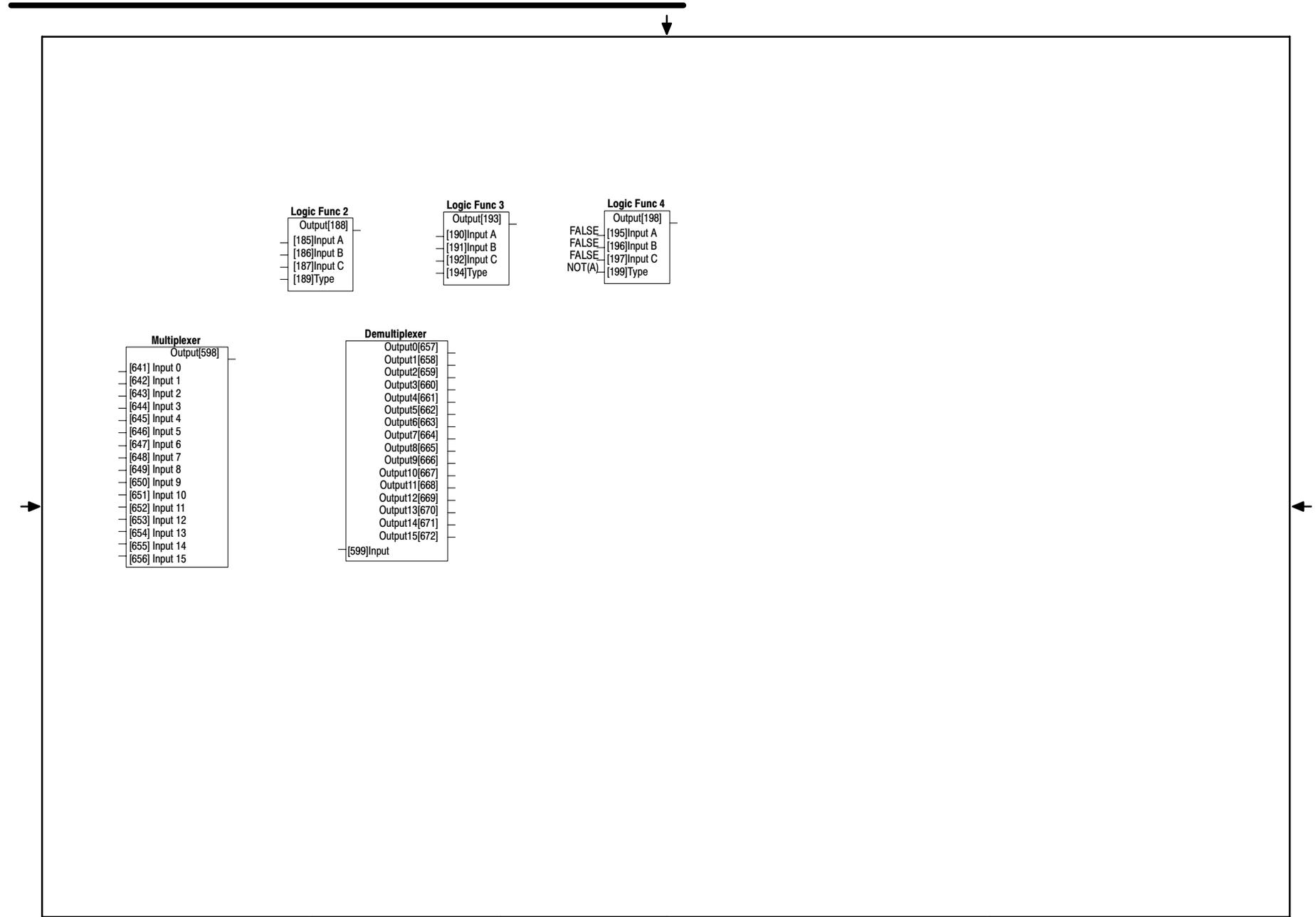
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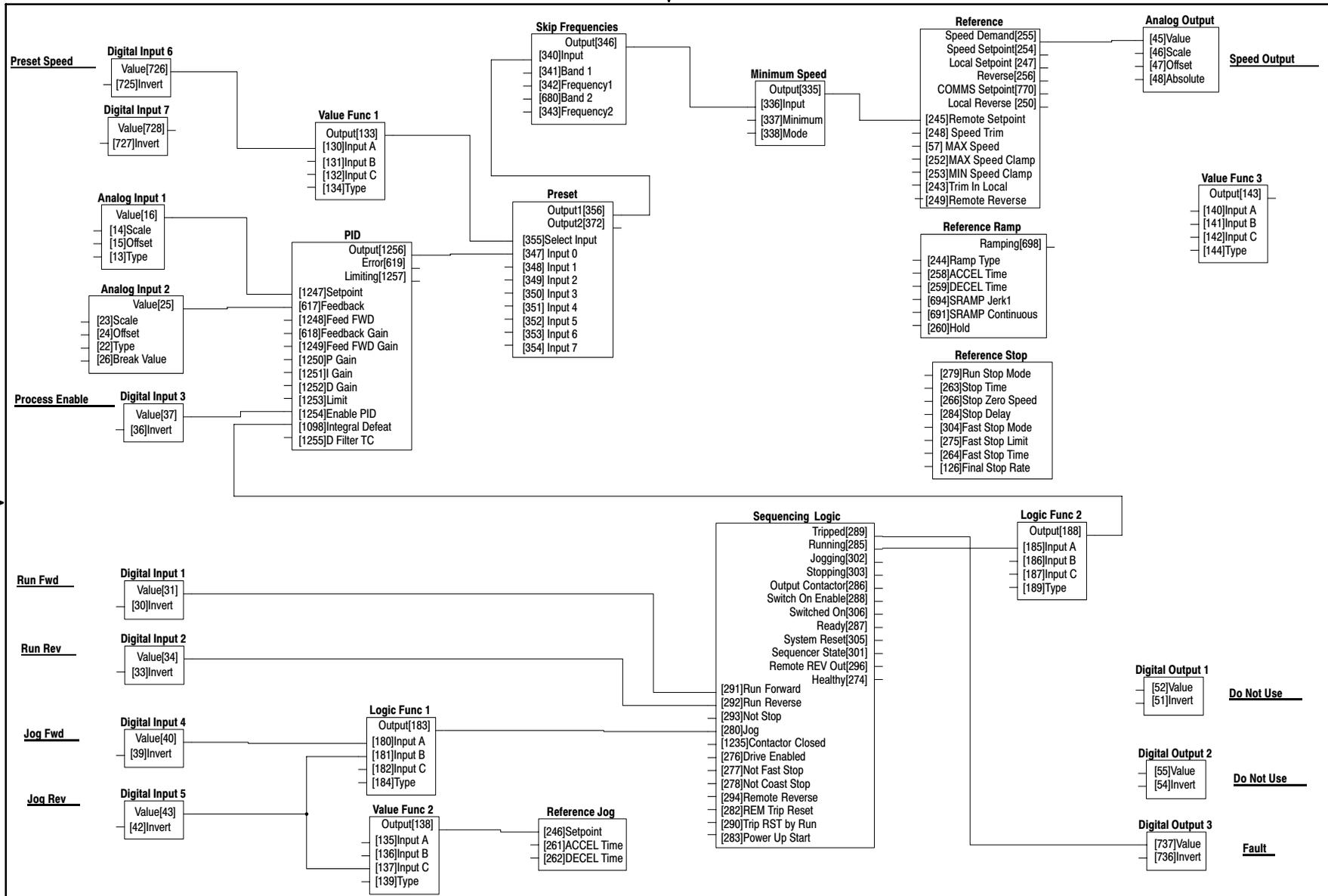
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	APP			SCALE	SHEET
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Important! Configurations display configurable connections and parameters only.	DWN			SIZE A	DWG. NO.
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	APP			SCALE	SHEET 3 OF 4

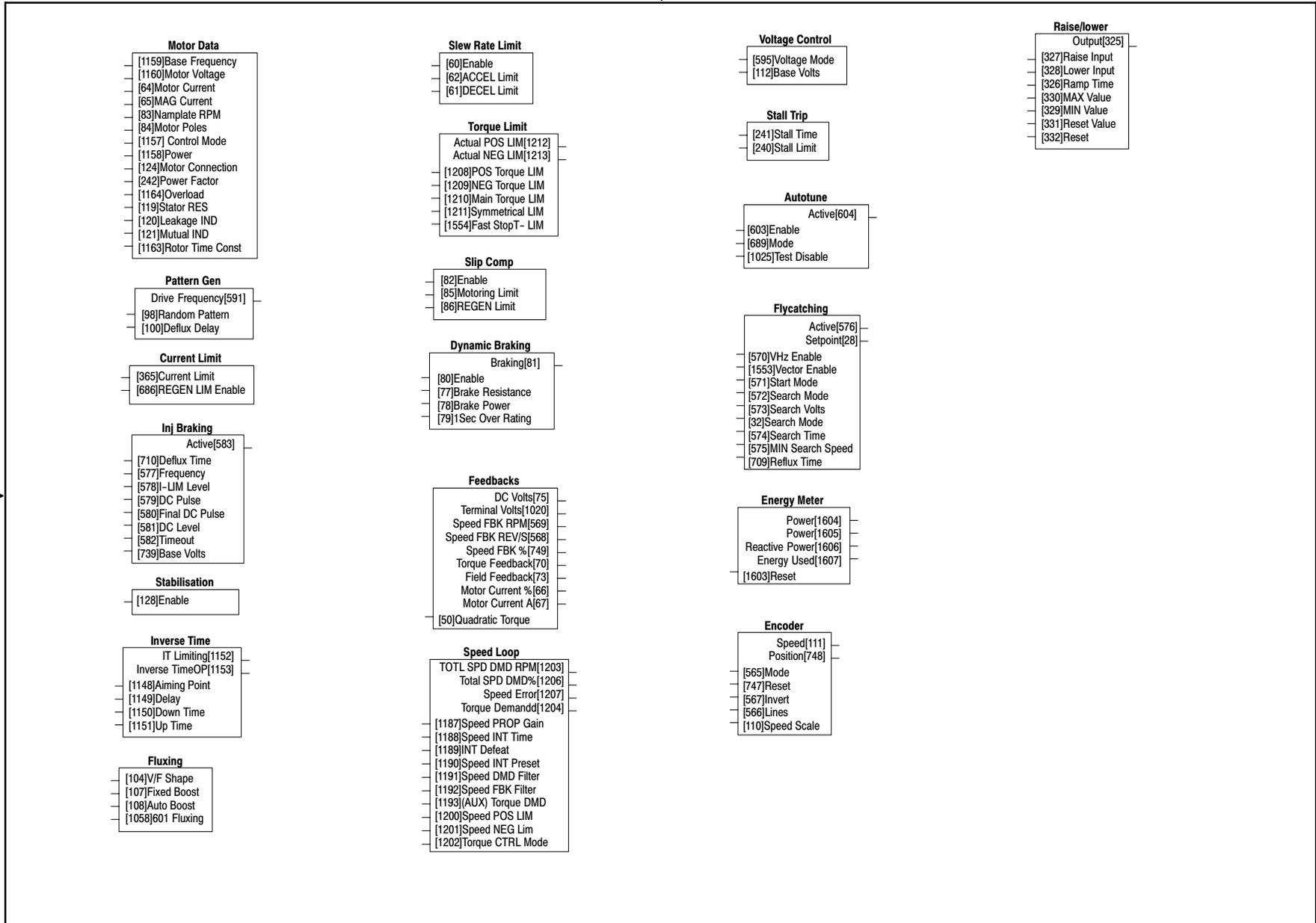


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	APP			SCALE	SHEET 4 OF 4

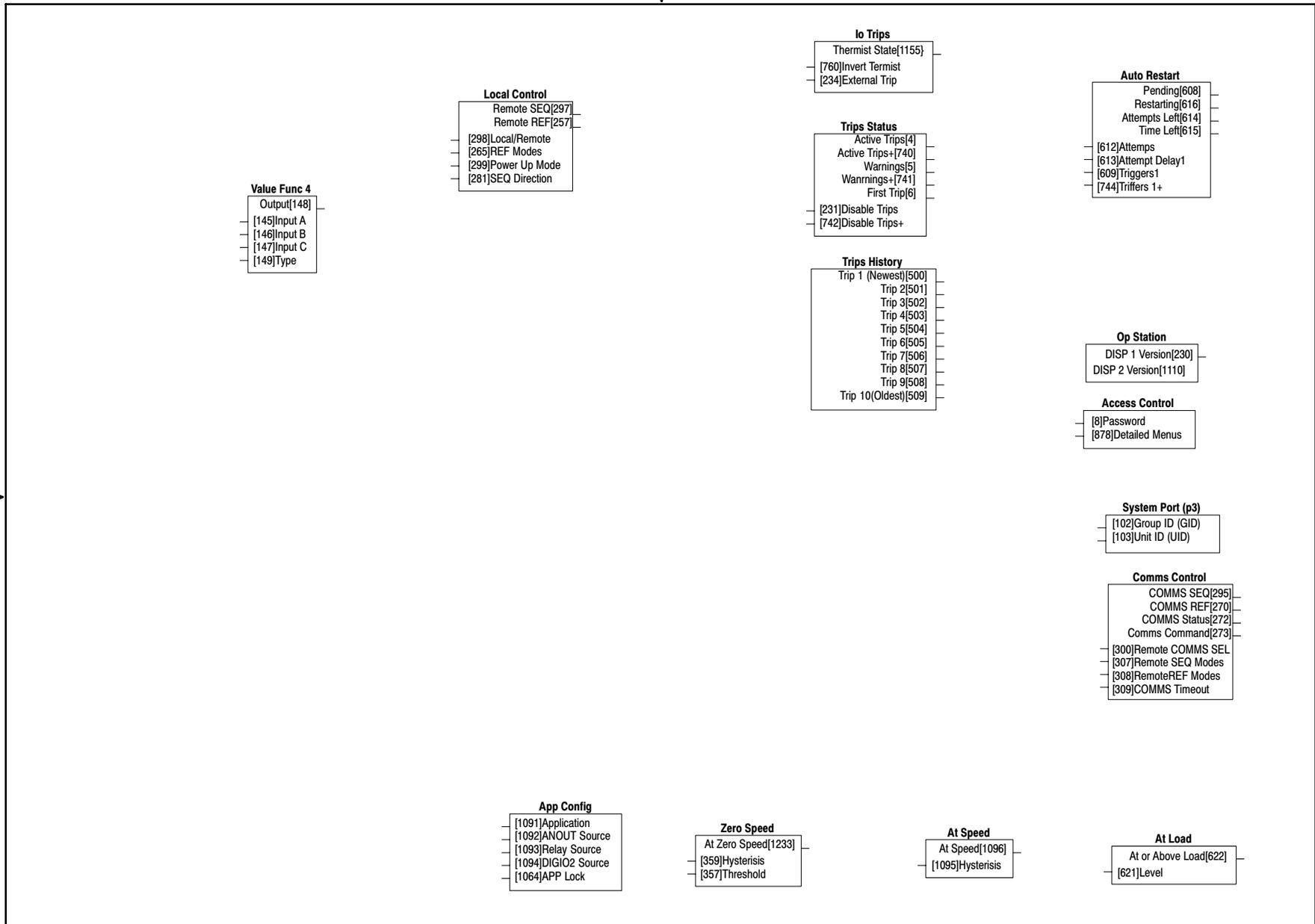


Baldor Macro 7: PID

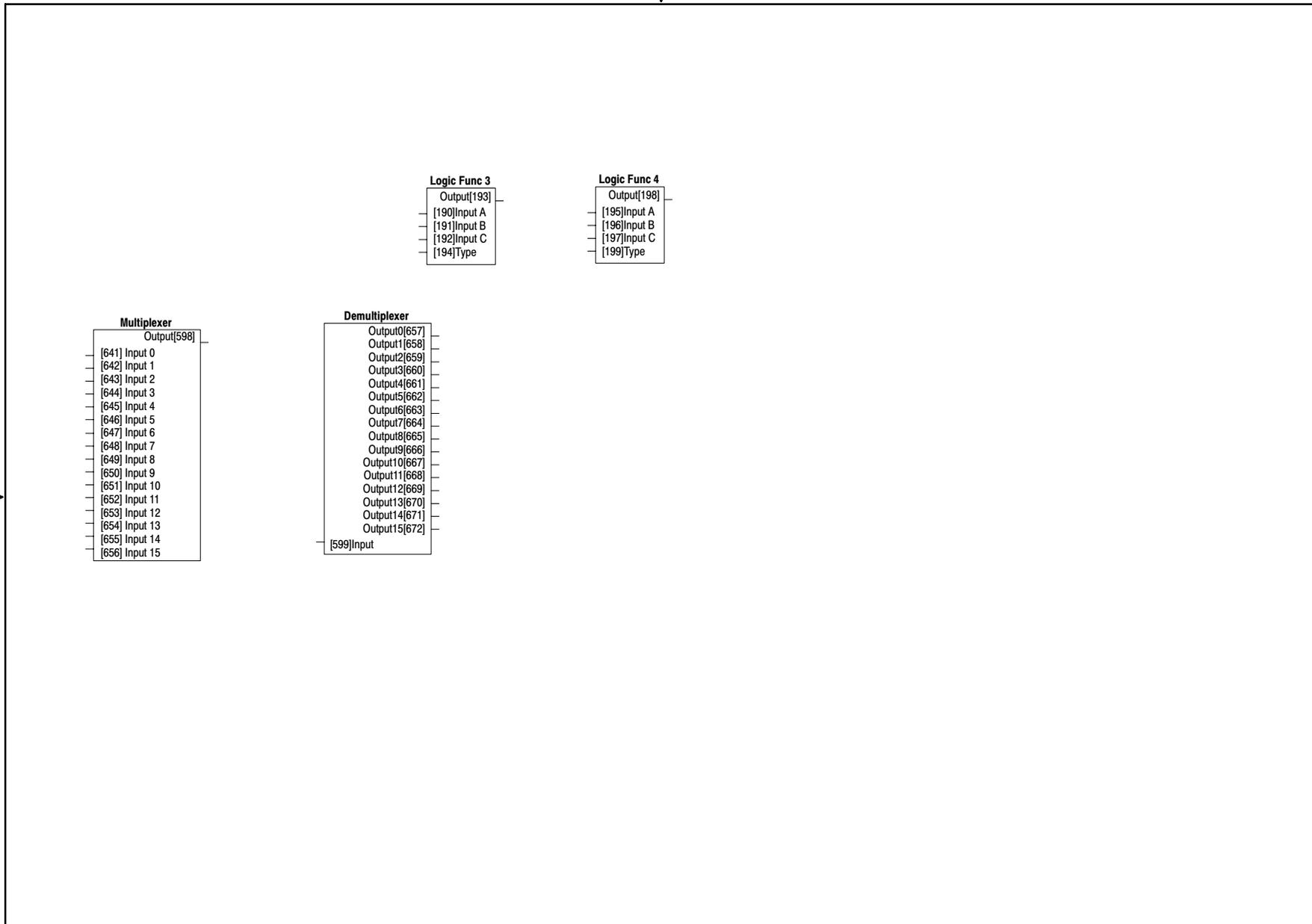
Important! Configurations display configurable connections and parameters only.	DWN			SIZE A	DWG. NO.
	CHK			ISSUE 1	25 Apr 02
	APP			SCALE	SHEET 1 OF 4



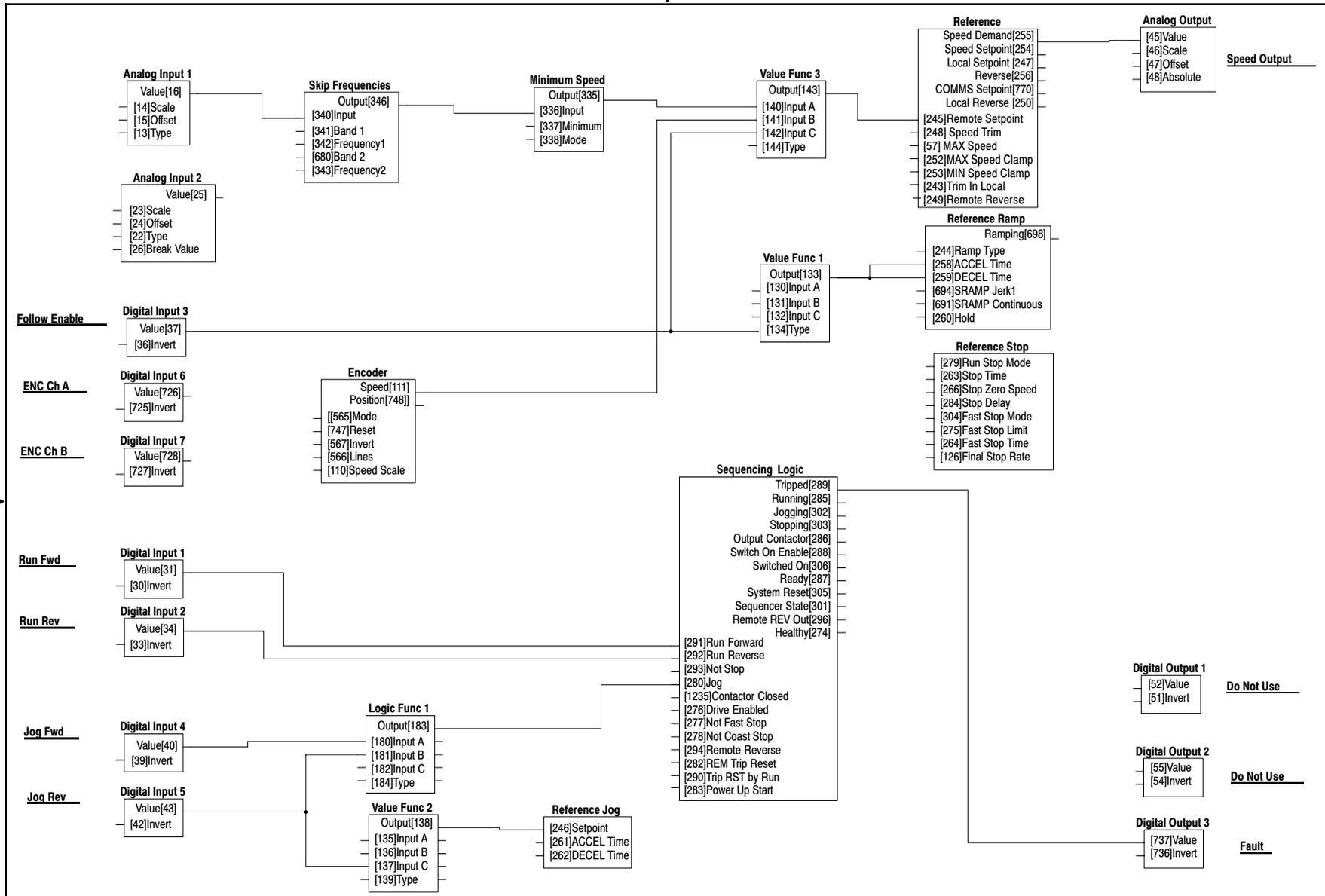
Important! Configurations display configurable connections and parameters only.	DWN			SIZE A	DWG. NO.
	CHK			ISSUE	1
	APP			SCALE	SHEET
					25 Apr 02
					2 OF 4



Important! Configurations display configurable connections and parameters only.	DWN			SIZE A	DWG. NO.
	CHK			ISSUE 1	25 Apr 02
	APP			SCALE	SHEET 3 OF 4

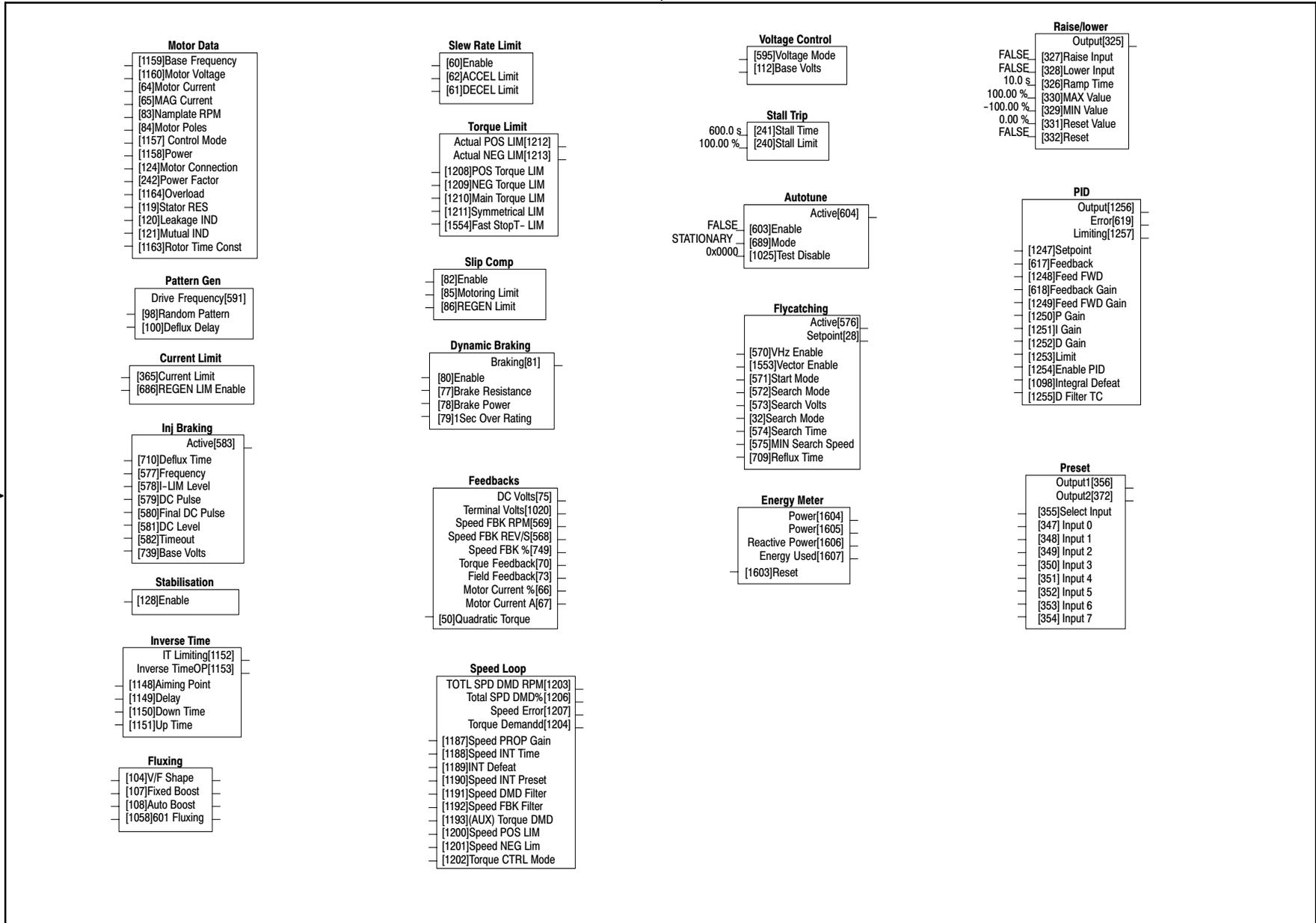


Important! Configurations display configurable connections and parameters only.	DWN			SIZE A	DWG. NO.
	CHK			ISSUE 1	25 Apr 02
	APP			SCALE	SHEET 4 OF 4

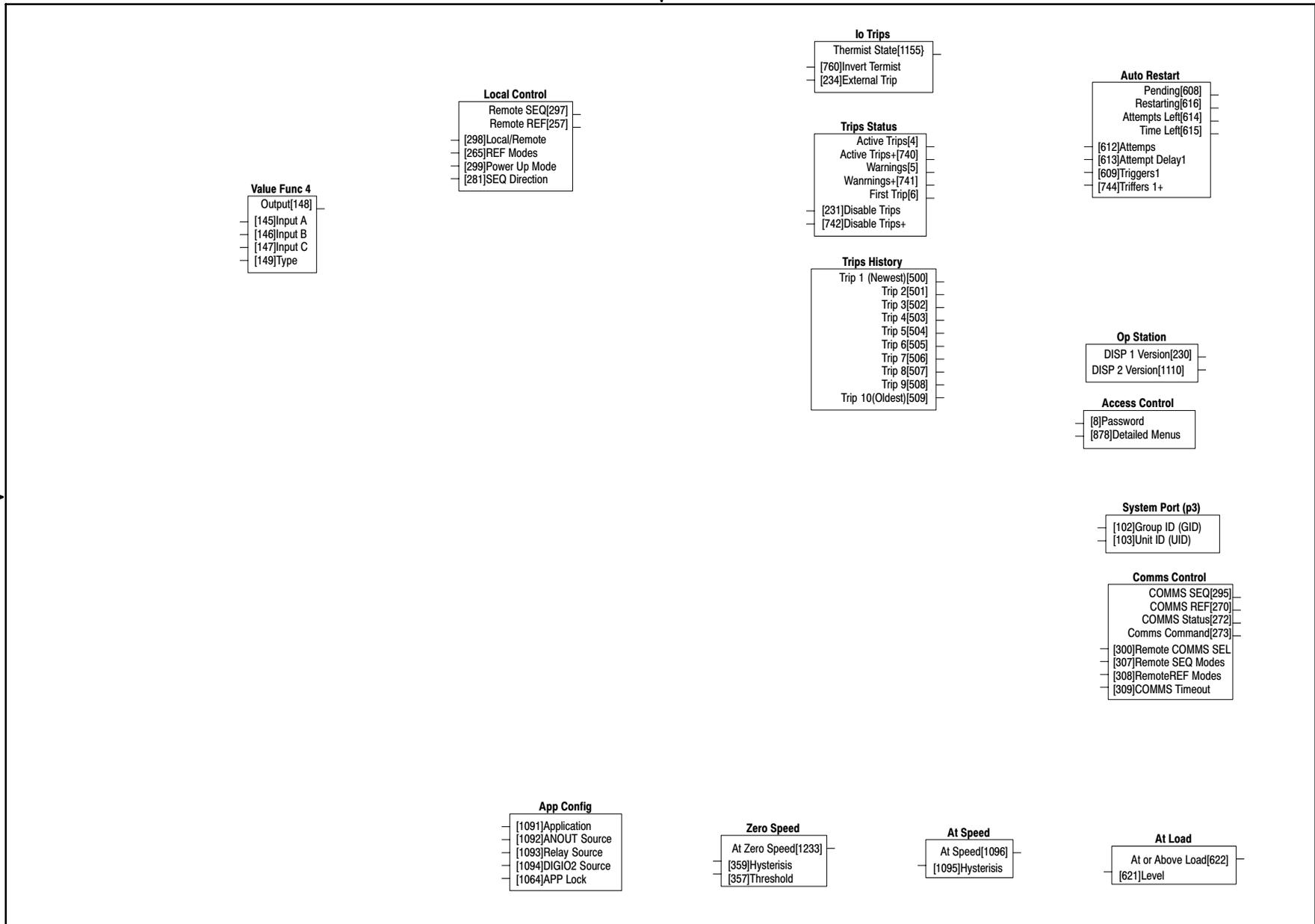


Baldor Macro 8: Encoder Follower

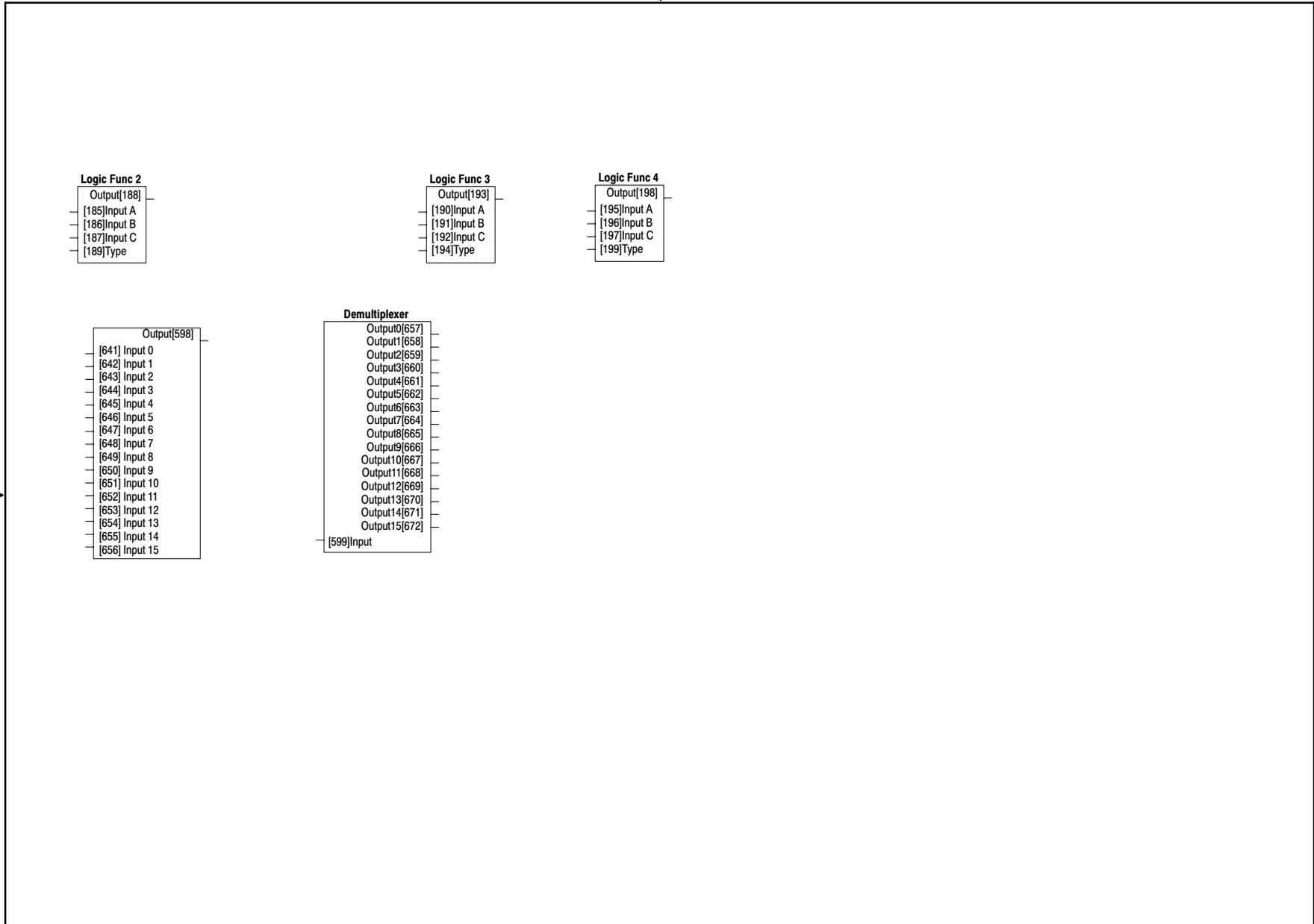
Important! Configurations display configurable connections and parameters only.	DWN			SIZE A	DWG. NO.	
	CHK			ISSUE 1		25 Apr 02
	APP			SCALE	SHEET	1 OF 4



Important! Configurations display configurable connections and parameters only.	DWN			SIZE A	DWG. NO.
	CHK			ISSUE	1
	APP			SCALE	SHEET
					25 Apr 02
					2 OF 4



Important! Configurations display configurable connections and parameters only.	DWN			SIZE A	DWG. NO.
	CHK			ISSUE 1	25 Apr 02
	APP			SCALE	SHEET 3 OF 4



Important! Configurations display configurable connections and parameters only.	DWN			SIZE A	DWG. NO.
	CHK			ISSUE 1	25 Apr 02
	APP			SCALE	SHEET 4 OF 4

Appendix D

Programming

Overview The shipping configuration allows the user to start up and run a motor in simple speed control from the keypad. The flexibility is having the ability to change configuration and to tune the control for optimum performance.

This chapter describes each of the parameters associated with the 37D configuration files within WorkbenchD.

The drive's parameters and function block inputs and outputs are defined as either a percentage if they are continuous, or as boolean value (1 or 0) if they are discrete. Depending on how the drive is configured, these parameters can represent physical entities such as motor speed or current. Connecting inputs or outputs to software function blocks or to real world signals defines what the function block inputs or outputs represent. For example, the output (Destination Tag) from the Raise/Lower function block can represent current demand if sent to the current loop or a speed setpoint if sent to the speed loop.

Connection Method

Connection of signals from an input or output of one block to an input or output of another block are made using WorkbenchD. The graphical user interface makes connections simple.

Parameter Types

Each drive parameter is associated with a unique address, or "tag." When "connecting" any parameter to drive inputs, outputs, or links, this tag is designated as the source or destination address. The drive parameters are listed by tag number, parameter name and menu group name in the appendix of this manual. There are only two types of parameters: logic or value.

Logic

Logic parameters are boolean – or either On (1) or Off (0). The keypad displays logic signals in a variety ways, each associated with the On and Off state like Enabled/ Disabled, True/False, Positive/Negative, or Even/Odd.

Value

Value parameters have a range of values depending on its function. The display is formatted appropriately (for example in percent). In all cases these values will not exceed five digits. For example, 100.00% is handled by the controller as 10000 and 30.00 as 3000. Other value parameters can be Logic values, HEX numbers, ordinals, and lists. The ranges of these values depend on the parameter type.

An output value (for example x.xx %) is dependent upon the blocks that provide the signal and it's value has an accuracy of one or two decimal places. the x.x or x.xx indicates the accuracy (one or two decimal places) and the units (% , A , V etc.) indicate the type of measurement.

Configuration Procedure

You can set the parameter values from the keypad or within WorkbenchD (see Manual MN794). The keypad has a limited number of parameter values that can be adjusted. Much more flexibility is provided with the WorkbenchD software. You can also configure the drive or connect and reconnect signals between drive function blocks and I/O terminals from the keypad or WorkbenchD. Parameters described in this section are in alphabetical order and are only available in WorkbenchD.

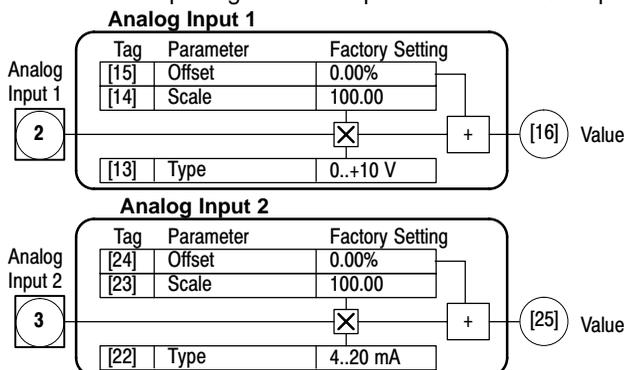
Make configuration changes from the keypad as follows:

1. Load one of the 37D configurations.
2. Find the input or output you want to change.
3. Link a source to a destination to connect signals of one block to another as required.
4. Set the or analog or digital I/O parameter calibrations as needed.
5. Save Parameters by saving the configuration to a new name.
6. Download the new configuration to the drive memory.
7. Run the new configuration.

Parameter Descriptions

Analog Inputs Two analog input blocks are used to scale and clamp the inputs for terminals 2 and 3. Analog input 1 is the 0–10V speed reference input. Analog input 2 is the 4–20mA input.

The input signal is pre-processed and converted to a numeric value. A scale factor is applied so that an input value of 0.00% represents an input equal to the low input range and an input value of 100.00% represents an input equal to the high input range. An Offset value is then added to the scaled input signal level to produce the Value output.



Parameter Descriptions

Type

The type of signal being applied to the input terminal.

Range: 0 : 0.5 V
 1 : 0..10 V
 2 : 0..20 mA
 3 : 4..20 mA

Scale

A scaling factor applied to the raw input. With a scaling factor of 100.00% and an offset of 0.00%, an input equal to the low input range will appear as a value of 0.00%. Similarly, an input equal to the high input range will appear as a value of 100.00%.

Range: -300.00 to 300.00 %

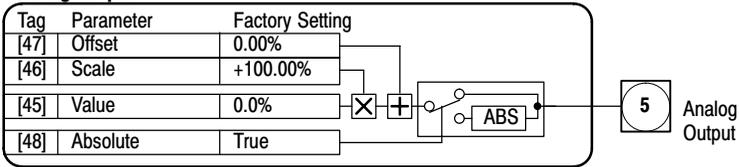
Offset

An offset added to the input after the scaling factor has been applied.

Range: -300.00 to 300.00 %

Analog Output One Analog Outputs is available. The analog output block converts the demand percentage into a signal level required at the analog output.

Analog Output



Parameter Descriptions

Value

The speed demand signal.

Range: 0 to 549

Scale

This value is based on the range of the source. It can be set positive or negative to set the sign of the output and scale the input to give a 10V output.

Range: -300.00 to 300.00 %

OFFSET

Offset value added to the input value after the scaler and before the ABS.

Range: -100.00 to 100.00 %

ABS – Absolute Value

Absolute value determines whether the analog output is bipolar or unipolar. False allows the input to pass through to the output (bipolar).

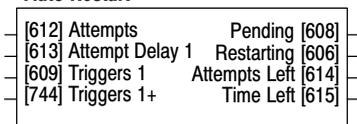
Range: 0 : False
1 : True

TRUE, the output is unipolar (will not go negative). Negative input values are made positive (absolute value).

Auto Restart Auto Restart provides an automatic reset after a trip. The number of attempts and other conditions are programmable if the drive is not successful at restart. The number of attempted restarts are recorded. If auto restart is not successful, a manual reset is required. This count is cleared after any of the following:

1. A trip-free period of operation (5 minutes or 4 x Attempt Delay 1, whichever is longer).
2. A successful manual or remote trip reset.
3. Removing the Run signal.
4. Setting the Enable input to this block to False.

Auto Restart



Parameter Descriptions

Pending (Output)

Indicates an auto restart will occur after the programmed "Attempt Delay 1".

Range: 0 : False
1 : True

Restarting (Output)

An auto restart is occurring. True for a single block diagram execution cycle.

Range: 0 : False
1 : True

Attempts Left (Output)

The number of remaining attempts before an external fault reset is required.

Range: x

Time Left (Output)

The time remaining before an auto restart attempt is allowed.

Range: x.x sec

Attempts

The number of restarts allowed before an external fault reset is required.

Range: 0000 to FFFF

Attempt Delay 1

The delay between restart attempts for a trip included in Triggers 1 . The delay is measured from all error conditions clearing.

Range: 0.0 to 600.0 sec

Triggers 1 and Triggers1+

Allows Auto Restart to be enabled for a selection of trip codes. If a trip is included in both TRIGGERS 1 and TRIGGERS 2, then the times associated with TRIGGERS 1 will take priority. Refer to the Section 5 Troubleshooting for an explanation of the trip codes.

Range: 0000 to FFFF

Autotune Autotune is an automatic test sequence to identify motor operating parameters. A motor model is used by both the Sensorless Vector and Closed-Loop Vector modes. You must perform an autotune before operating in either Vector control modes.

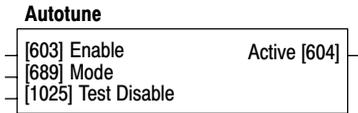
The autotune sequence identifies the following motor parameters:

- Per-phase stator resistance (Stator RES)
- Per-phase leakage inductance (Leakage INDUC)
- Per-phase mutual inductance (Mutual INDUC)
- Rotor time constant (Rotor Time CONST)
- No-load magnetizing line current (MAG Current)
- The encoder direction (Encoder Invert)

During the Rotating autotune sequence the motor rotates to MAX Speed (Setpoint Scale block).

The Stationary autotune sequence does not rotate the motor and requires the Magnetizing Current parameter to be manually entered.

These values are stored in the Motor Data block. Autotune will overwrite any previously stored values. Autotune can only be initiated from the stopped condition. When complete, the control is disabled and Enable [603] is set to False.



Parameter Descriptions

Active (Output)

Indicates the current state of the Autotune sequence. True = Autotune sequence is active, False = Autotune sequence is finished or not active.

Range: 0 : False
1 : True

Enable

Enables the Autotune sequence. Autotune sequence is operational when set to True and the drive is run.

Range: 0 : False
1 : True

Mode

Selects the Autotune operating mode.

Range: 0 : Rotating
1 : Stationary

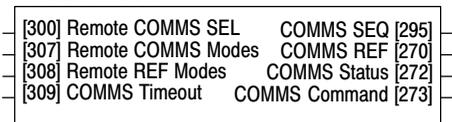
Test Disable

This parameter expands on the MMI to show four tests. Each test can be individually disabled by setting to TRUE.

Range: 0 : Stator RES
1 : Leakage IND
2 : Encoder DIR
3 : Mag Current

COMMS Control This block switches between Remote Terminal and Remote Comms operating modes. The Inverter must be in Remote mode for selection to be made –Remote mode is enabled in the Local Control block (REF Modes) and selected by the Operator Station. Refer to the outputs of the Local Control block for the mode in use.

COMMS Control



Parameter Descriptions

COMMS SEQ (Output) Range: 0 : False
 True if operating in Remote Sequencing Comms Mode. 1 : True

COMMS REF (Output) Range: 0 : False
 True if operating in Remote Reference Comms Mode. 1 : True

COMMS Status (Output) Range: 0000 to FFFF
 The 16-bit Status word as seen by the communications.

COMMS Command (Output) Range: 0000 to FFFF
 The 16-bit Command as written by the communications.

Remote COMMS SEL Range: 0 : False
 Selects the type of remote communications mode: 1 : True
 False, and in Remote mode then control is from the terminals.
 True, and in Remote mode then control is from the communications.

Remote COMMS Modes Range: 0 : Terminals/Comms
 Sets the type of remote sequence mode. 1 : Terminals Only
 2 : Comms Only

Remote REF Modes Range: 0 : Terminals/Comms
 Sets the type of remote reference mode. 1 : Terminals Only
 2 : Comms Only

COMMS Timeout Range: 0.0 to 600.0 sec
 Sets the maximum time allowed between refreshing the COMMS Command parameter.
 The drive will trip if this time is exceeded. 0.00 seconds disables this feature.

Current Limit The value of measured motor current at which current limit action occurs. If the measured motor current exceeds the current limit value with a motoring load, the motor speed is reduced to shed the excess load. If the measured motor current exceeds the current limit value with a regenerating load (REGEN Limit), the motor speed is increased up to a maximum of MAX Speed (Setpoint Scale function block).

Current Limit

[365] Current Limit
[686] Regen LIM Enable

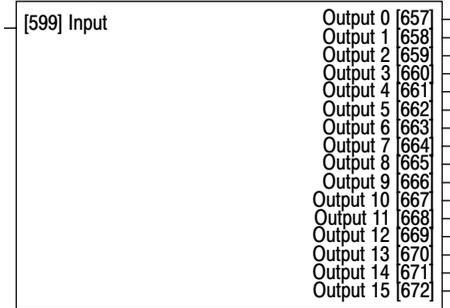
Parameter Descriptions

Current Limit Range: 0.00 to 150.00 %
Sets the maximum motor current (as a % of the user-set Motor Current) before current limit action occurs.

Regen LIM Enable Range: 0 : False
Enables (True) or disables (False) regenerative current limit action.
1 : True
(This parameter only works in open-loop Volts / Hz mode.)

Demultiplexer The demultiplexer divides the input word into 16 individual signals or bits. As an example, this can be used to extract the individual trip bits from the Active Trips parameter. Also see Multiplexer.

Demultiplexer



Parameter Descriptions

Input

The 16 bit input word to be decoded.

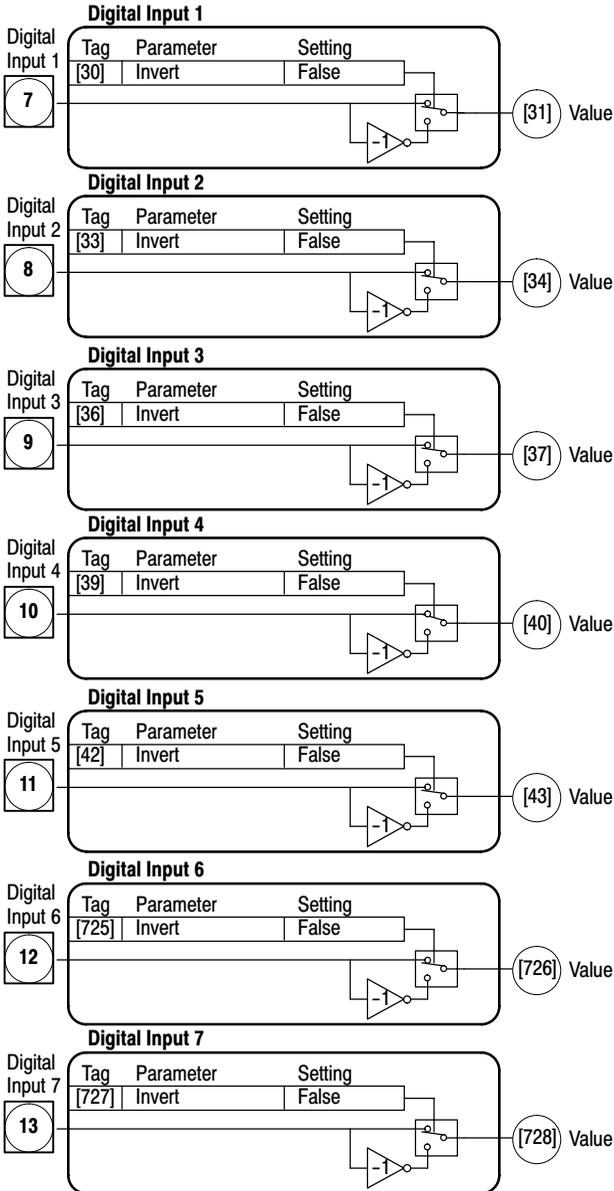
Output 0 to 15

Each output is set true or false depending upon the corresponding bit of the 16 bit input word.

Range: 0000 to FFFF

Range: 0 : False
1 : True

Digital Input Allows remote operation by the terminal strip. Each digital input can be configured to point to a destination tag and to set that destination true or false depending upon programmable values.



Digital Input Continued

Parameter Descriptions

Value (Output)

The output representation of the digital input.

Range: 0 to 549

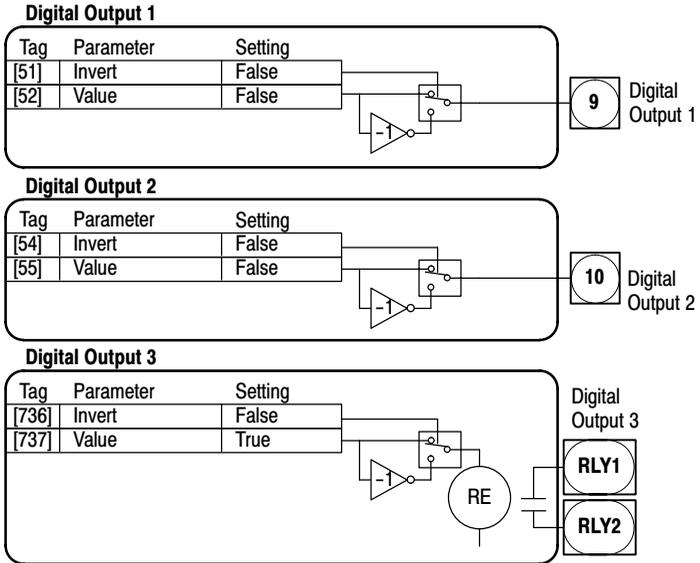
Invert

False = no inversion of the input (input=output).

True = invert the input signal (true input = false output)

Range: -300.00 to 300.00 %

Digital Output Allows a 0 or 1 value (fault etc.) to be sent to an external device.



Parameter Descriptions

Value

The logic value to be sent to the output.

Invert

False = no inversion of the input (input=output).

True = invert the input signal (true input = false output, etc.).

Range: 0 : False
1 : True

Range: 0 : False
1 : True

Dynamic Braking Dynamic braking controls the rate at which energy from a regenerating motor is dissipated by a resistive load. This prevents the dc link voltage from reaching levels that will cause an Overvoltage trip.

Dynamic Braking



Parameter Descriptions

Braking (Output) Range: 0 : False
 False = Dynamic Brake is not active. 1 : True
 True = Dynamic Brake is active.

Enable Range: 0 : False
 Enables dynamic braking. 1 : True

Brake Resistance Range: 1 to 1000 Ohm
 The resistor rating of the load resistance.

Brake Power Range: 0.1 to 510.0 kW
 The dissipation rating of the load resistance.

1Second Over Rating Range: 1 to 40
 A multiplier value to be applied to Brake Power for overloads that last less than 1second.

$$1\text{Second Over Rating} = \frac{1 \text{ Second Control Peak Power Rating}}{\text{Brake Power}}$$

Feedbacks Allows viewing of certain speed feedback and motor parameter values.

Feedbacks	
[50] Quadratic Torque	DC Link Volts [75]
	Terminal Volts [1020]
	Speed Fbk RPM [569]
	Speed Fbk Rev/S [568]
	Speed Fbk % [749]
	Torque Feedback [70]
	Field Feedback [73]
	Motor Current % [66]
	Motor Current A [67]

Parameter Descriptions

DC Link Volts (Output) Range: x.x V
 The voltage on the dc link capacitors (Bus voltage).

Terminal Volts (Output) Range: x.x V
 The phase to phase RMS voltage applied to the motor terminals. This should be 90% of Motor Volts at base speed if the motor is unloaded.

Speed Fbk RPM (Output) Range: x.xx RPM

- In Closed-loop Vector mode the parameter shows the mechanical speed of the motor shaft in revolutions per minute as calculated from the Encoder expansion board.
- In Sensorless Vector mode the parameter shows the calculated mechanical speed of the motor shaft in revolutions per minute.

Speed Fbk Rev/S (Output) Range: x.xx Rev/s

- In Closed-loop Vector mode the parameter shows the mechanical speed of the motor shaft in revolutions per second as calculated from the Encoder expansion board.
- In Sensorless Vector mode the parameter shows the calculated mechanical speed of the motor shaft in revolutions per second.
- In Volts / Hz mode, the parameter shows the motor synchronous speed in revolutions per second.

Feedbacks Continued

Parameter Descriptions

Speed Fbk % (Output)

Range: x.xx %

- In Closed-loop Vector mode the parameter shows the mechanical speed of the motor shaft as a percentage of the user maximum speed setting (MAX Speed in the Setpoint Scale function block) as calculated from the Encoder expansion board.
- In Sensorless Vector mode the parameter shows the calculated mechanical speed of the motor shaft as a percentage of the user maximum speed setting (MAX Speed in the Setpoint Scale function block).
- In Volts / Hz mode, the parameter shows the output frequency as a percentage of the user maximum speed setting (MAX Speed in the Setpoint Scale function block).

Torque Feedback (Output)

Range: x.xx %

Shows the estimated motor torque, as a percentage of rated motor torque.

Field Feedback (Output)

Range: x.xx %

A value of 100% indicates the motor is operating at rated magnetic flux (field).

Motor Current % (Output)

Range: x.xx %

The RMS line current used by the motor as a % of the Motor Current parameter in the Motor Data function block.

Motor Current A (Output)

Range: x.xx A

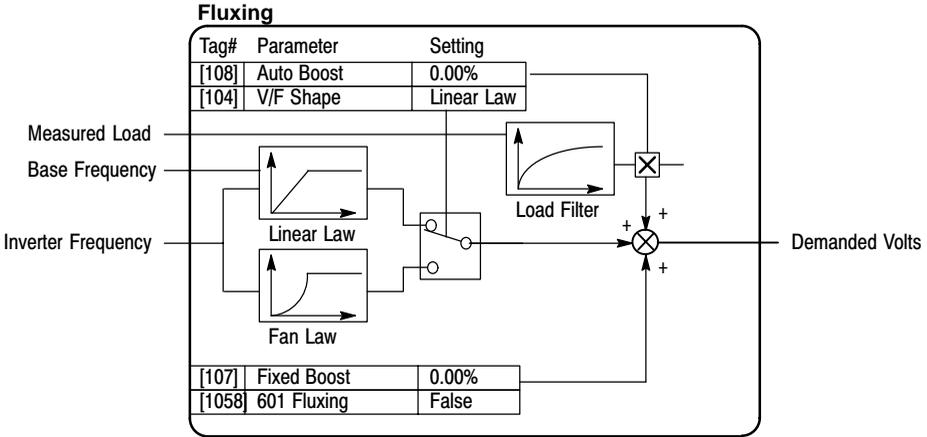
The RMS line current being used by the motor.

Quadratic Torque

Range: 0 : False
1 : True

When TRUE, selects higher continuous ratings with less overload capability. This mode is especially suited for fan or pump applications.

Fluxing Allows customization of the conventional parameters for volts/hertz operation. Starting torque can also be adjusted with the Fixed Boost and Auto Boost parameters. Correct adjustment (motor is operating at rated magnetic flux) is achieved when Field FBK in the Feedbacks block indicates 100%.



Parameter Descriptions

V/F Shape

Sets the Volts/Frequency ratio of the output to the motor for all values of output voltage versus output frequency. Because motor voltage is related to motor current, motor voltage can be related to motor torque. A change in the V/Hz profile can adjust how much motor torque is available at various speeds.

Range: 0 : Linear Law
1 : Fan Law

Base Frequency

The point on the V/Hz profile at which output voltage becomes constant with increasing output frequency (constant hp). Below base frequency, the volts will vary with frequency as determined by the V/F Shape parameter. Above base frequency, the volts will saturate at the maximum value.

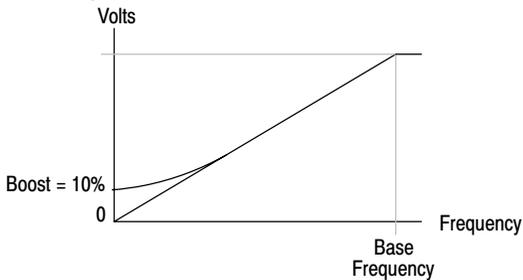
Range: 7.5 to 500.0 Hz

Fixed Boost (Low Frequency Adjustment)

This parameter allows for no-load stator resistance voltage drop compensation. This correctly fluxes the motor (under no-load conditions) at low output frequencies, thereby increasing available motor torque. Fixed boost can be set in addition to auto boost.

Range: 0.00 to 25.00 %

Fluxing Continued
Parameter Descriptions



Auto Boost (Under Load Adjustment)

Allows for load dependent stator resistance voltage drop compensation. This correctly sets the Volts/Frequency ratio at low output frequencies to increase motor torque. Auto boost can be set in addition to fixed boost. The value of the Auto Boost parameter determines level of additional volts supplied to the motor for 100% load. Setting the value of auto boost too high can cause the control to enter current limit. If this occurs, the control will be unable to ramp up in speed. Reducing the value of auto boost will correct this problem.

Range: 0.00 to 25.00 %

Flycatching Flycatching allows the drive to be restarted smoothly with a rotating motor. It applies small search voltages to the motor while ramping the Inverter frequency from maximum speed to zero. When the motor load goes from motoring to regenerating, the speed search has succeeded and is terminated. If the search frequency decreases below the minimum search speed, the speed search has failed and the Inverter will ramp to the speed setpoint from zero.

It allows the control to detect and match a spinning motor before controlling the motor. Once the motor is “caught” the control can bring it to the desired setpoint. Especially useful for large inertia fan loads, where drafts in building air ducts can cause a fan to “windmill”.

The flycatching sequence can be triggered by different starting modes:

ALWAYS: All starts (after controlled or uncontrolled stop, or after a power-up)

TRIP or POWER-UP: After uncontrolled stop, i.e. trip or coast, or after a power-up

TRIP: After uncontrolled stop, i.e. trip or coast

Flycatching

[570] Enable	Active [576]
[1553] Vector Enable	Setpoint [28]
[571] Start Mode	
[572] Search Mode	
[573] Search Volts	
[32] Search Boost	
[574] Search Time	
[575] MIN Search Speed	
[709] Reflux Time	

Parameter Descriptions

Active (Output) Range: 0 : False
Indicates if flycatching is active. 1 : True

Setpoint (Output) Range: xxx.xx %
The setpoint caught at the end of a successful flycatching sequence.

Enable Range: 0 : False
Enables flycatching in Volts/Hz Control mode when TRUE. 1 : True

Vector Enable Range: 0 : False
Enables flycatching in Vector Control mode when TRUE. 1 : True

Start Mode Range: 0 : Always
The mode for the flycatching sequence. 1 : Trip Or Powerup
2 : Trip

Search Mode Range: 0 : Bidirectional
Unidirectional – The search is performed only in the direction of the speed setpoint. 1 : Unidirectional
Bidirectional – Search begins in the direction of the speed setpoint. If the drive fails to identify the motor speed in this direction, a second speed search is performed in the reverse direction.

Flycatching Continued

Parameter Descriptions

Search Volts

The maximum motor voltage for the search. Increasing this parameter improves the accuracy of the discovered motor speed but increases the braking influence of the speed search on the rotating motor.

Range: 0.00 to 100.00 %

Search Boost

The level of search boost applied to the motor during the speed search phase of the flycatching sequence.

Range: 0.00 to 50.00 %

Search Time

The search rate during the speed search phase of the flycatching sequence. Performing the flycatching speed search too quickly can cause the drive to inaccurately identify the motor speed and cause the drive to trip on overvoltage. If this occurs, increasing this parameter will reduce the risk of tripping.

Range: 0.1 to 60.0 sec

MIN Search Speed

The slowest search speed before the search is considered to have failed.

Range: 0.0 to 500.0 Hz

Reflux Time

The rate of increase of volts from the search level to the working level after a successful search. Too low a setting cause the drive to trip on either overvoltage or overcurrent.

In either case, increasing this parameter will reduce the risk of tripping.

Range: 0.1 to 20.0 s

INJ Braking A method to stop an induction motor without returning regenerative energy of the motor and load back to the dc link. On a stop command, the motor volts are rapidly reduced at constant frequency. A low frequency braking current is then applied until the motor speed is almost zero. This is followed by a timed DC pulse to hold the motor shaft. The stored energy is dissipated in the motor. Thus, high inertia loads may be stopped without the need for an external dynamic braking resistor.

INJ Braking	
[710] Deflux Time	Active [583]
[577] Frequency	
[578] I-Lim Level	
[579] DC Pulse	
[580] Final DC Pulse	
[581] DC Level	
[582] Timeout	
[739] Base Volts	

Parameter Descriptions

- Active** (Output) Range: 0 : False
TRUE when injection braking is active. 1 : True
- Deflux Time** Range: 0.1 to 20.0 sec
The time the control decreases the motor volts prior to injection braking.
- Frequency** Range: 1.0 to 480.0 Hz
The maximum frequency applied to the motor for the low frequency injection braking mode. It is also limited to never to exceed 50% of base speed value.
- I-Lim Level** Range: 50.00 to 150.00 %
The amount of motor current during low frequency injection braking.
- DC Pulse** Range: 0.0 to 100.0 sec
The duration of the DC pulse applied to the motor during injection braking for motor speeds less than 20% of base speed. The actual DC pulse time applied to the motor is dependent on the ratio of initial motor speed to 20% of base speed.
- Final DC Pulse** Range: 0.0 to 10.0 sec
The duration of the final DC holding pulse applied to the motor after either low frequency injection braking or timed dc pulse.
- DC Level** Range: 0.00 to 25.00 %
The level of DC pulse applied to the motor during either the timed or final dc pulse.
- Timeout** Range: 0.0 to 600.0 sec
The maximum time duration allowed for the low frequency injection braking to be active.
- Base Volts** Range: 0.00 to 115.47 %
The maximum motor volts at base speed during injection braking.

I/O Trips Works with the Analog and Digital Input blocks to trip the control on a loss of setpoint input or safety control input.



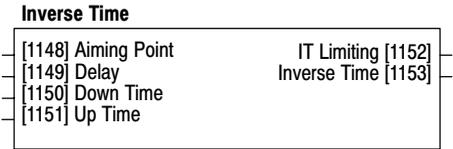
Parameter Descriptions

Thermist (Output) Range: 0 : False
1 : True
The state of the motor thermistor trip input, modified by Invert Thermistor input.

Invert Thermist Range: 0 : False
1 : True
When True, inverts the motor thermistor input level. FALSE is normally-closed/low impedance.

External Trip Range: 0 : False
1 : True
The current state of the External Trip input (Motor/Temp). Note that this input is inverted, so TRUE indicates 0V is on the terminal.

Inverse Time The inverse time function automatically reduces the current limit during prolonged overload conditions. As the motor current exceeds the Aiming Point level, the excess current is integrated. Up to 150.0 % rated motor current is allowed to flow for a period defined by the Delay parameter. At this point the inverse time current limit is ramped down from 150.0 % to the level defined by Aiming Point. The rate at which the inverse time current limit is ramped to the Aiming Point is defined by Down Time. Once the overload condition is removed, the inverse time current limit level is ramped back toward the 150.0 % level at a rate defined by Up Time. In Quadratic Torque mode, the allowed overload is reduced to 115.0 % for 60.0 s before inverse time current limit action occurs.

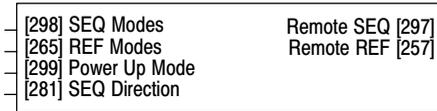


Parameter Descriptions

- IT Limiting** (Output) Range: 0 : False
True indicates the inverse time current limit is active. 1 : True
- Inverse Time** (Output) Range: x.xx %
Indicates the present level of the inverse time current limit.
- Aiming Point** Range: 50.00 to 150.00%
The final level of the inverse time current limit after a prolonged motor overload.
- Delay** Range: 5.0 to 60.0sec
The maximum allowed overload duration for 150.0 % motor current (110.0% in Quadratic Torque mode) before inverse time current limit action takes over.
- Down Time** Range: 1.0 to 10.0sec
The rate at which the inverse time current limit is ramped to the Aiming Point after a prolonged overload.
- Up Time** Range: 1.0 to 600.0sec
The rated at which the inverse time current limit is ramped to 150.0 % (110.0 % in Quadratic Torque mode) after the overload is removed.

Local Control Allows the Local and Remote modes to be customized. It also indicates the selected mode. You can only switch between Local and Remote modes using the Operator Station (by pressing the L/R key).

Local Control



Parameter Descriptions

Remote SEQ (Output) Range: 0 : False
 Indicates the present source of the sequencing commands. True = Remote. 1 : True

Remote REF (Output) Range: 0 : False
 Indicates the present source of the reference signal. True = Remote. 1 : True

SEQ Modes Range: 0 : Local/Remote
 Selects the source of sequencing commands. 1 : Local Only
 (Local =Keypad, Remote = is an external signal at the terminal strip.) 2 : Remote Only

REF Modes Range: 0 : Local/Remote
 Selects the source of the reference signal to be selected. 1 : Local Only
 (Local =Keypad, Remote = is an external signal at the terminal strip.) 2 : Remote Only

Power Up Mode Range: 0 : Local
 Allows the power-up mode to be selected. 1 : Remote
 (Local =Keypad, Remote = is an external signal at the terminal strip, Automatic = the same mode as when powered down.) 2 : Automatic

SEQ Direction Range: 0 : False
 When TRUE, direction is a Sequencing command. 1 : True
 When FALSE, direction is a Reference command.

Logic Function These blocks can be configured to perform a simple logic operation on the inputs.

Logic Func 1



Logic Func 3



Logic Func 2



Logic Func 4



Parameter Descriptions

Output

The result of performing the logical operation on the input values.

Range: 0 : False
1 : True

Input A

Logical input signal (True/False).

Range: 0 : False
1 : True

Input B

Logical input signal (True/False).

Range: 0 : False
1 : True

Input C

Logical input signal (True/False).

Range: 0 : False
1 : True

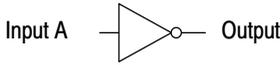
Type

The logical operation to be performed on the three inputs.

Range: 0 : NOT(A)
1 : AND(A,B,C)
2 : NAND(A,B,C)
3 : OR(A,B,C)
4 : NOR(A,B,C)
5 : XOR(A,B)
6 : 0-1 EDGE(A)
7 : 1-0 EDGE(A)
8 : AND(A,B,IC)
9 : OR(A,B,IC)
10 : S FLIP-FLOP
11 : R FLIP-FLOP

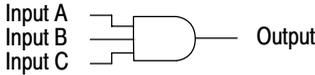
Logic Function Continued

NOT(A)



Invert input A.
 If Input A is True, the output is False.
 If Input A is False, the output is True.

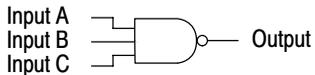
AND(A, B, C)



AND Inputs A, B and C.
 If all inputs are True, the output is True.
 Otherwise, the output is False.

Input			Output
A	B	C	
False	False	False	False
True	False	False	False
...
True	True	False	False
True	True	True	True

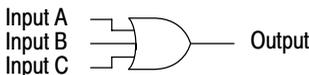
NAND(A, B, C)



NAND Inputs A, B and C.
 If all inputs are True, the output is False.
 Otherwise, the output is True.

Input			Output
A	B	C	
False	False	False	True
True	False	False	True
...
True	True	False	True
True	True	True	False

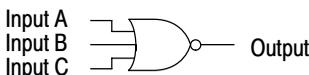
OR(A, B, C)



OR Inputs A, B and C.
 If one or more input is True, the output is True.
 Otherwise, the output is False.

Input			Output
A	B	C	
False	False	False	False
True	False	False	True
...
True	True	False	True
True	True	True	True

NOR(A, B, C)

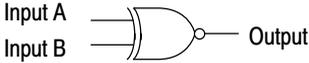


NOR Inputs A, B and C.
 If one or more input is True, the output is False.
 Otherwise, the output is True.

Input			Output
A	B	C	
False	False	False	True
True	False	False	False
...
True	True	False	False
True	True	True	False

Logic Function Continued

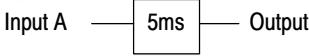
XOR(A, B)



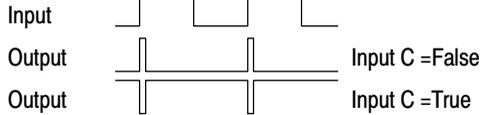
XOR Inputs A and B.
If both inputs are the same, the output is False.
Otherwise, the output is True.

A	Input B	Output
False	False	False
True	False	True
False	True	True
True	True	False

0-1 Edge(A)



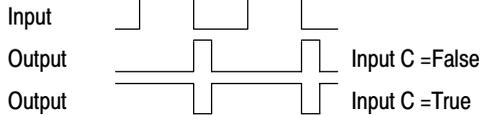
Rising edge trigger. Input B not used.
Output is a 5msec pulse when Input A becomes True.
When Input C is True, the output is inverted.



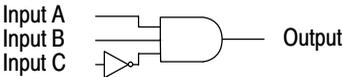
1-0 Edge(A)



Rising edge trigger. Input B not used.
Output is a 20msec pulse when Input A becomes False.
When Input C is True, the output is inverted.



AND(A, B, !C)

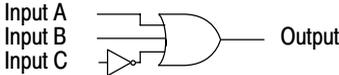


AND Inputs A, B and Inverted C.

A	Input B	C	Output
False	False	False	False
False	False	True	False
False	True	False	False
False	True	True	False
True	False	False	False
True	False	True	False
True	True	False	True
True	True	True	False

Logic Function Continued

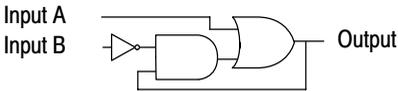
OR(A, B, !C)



OR Inputs A, B and Inverted C.

Input			Output
A	B	C	
False	False	False	True
False	False	True	False
False	True	False	True
False	True	True	True
True	False	False	True
True	False	True	True
True	True	False	True
True	True	True	True

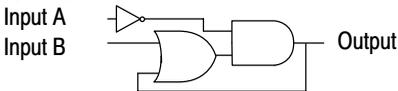
S Flip-Flop



Set dominant flip-flop.
Input A is the Set input.
Input B is the Reset input.
A True at Input A sets the Output True until a True at Input B resets the Output to False.

Input		Output
A	B	
False	False	False
False	True	False
True	False	True
True	True	False

R Flip-Flop



Reset dominant flip-flop.
Input A is the Reset input.
Input B is the Set input.
A True at Input B sets the Output True until a True at Input A resets the Output to False.

Input		Output
A	B	
False	False	False
False	True	True
True	False	False
True	True	False

Minimum Speed The minimum speed block determines how to follow a reference signal. There are two modes:

1. Proportional : minimum limit
2. Linear : between minimum and maximum.

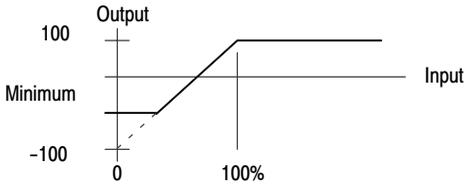


Parameter Descriptions

Output The output is determined by the MODE selected.	Range: x.xx%
Input Reference input to the block.	Range: -300.00 to 300.00 %
Minimum Sets the minimum value of the output.	Range: -100.00 to 100.00 %
Mode Sets the operating mode of the block.	Range: 0 : PROP. W/MIN. 1 : LINEAR

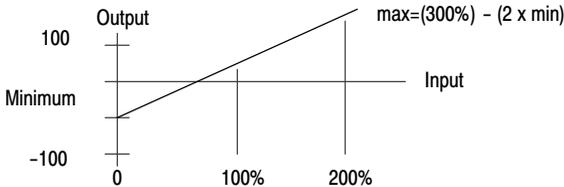
Proportional With Minimum

In this mode, the MINIMUM SPEED block acts as simple clamp. The minimum value has the valid range -100% to 100% and the output is always greater than or equal to the minimum value.



Linear

In this mode the MINIMUM SPEED block first clamps the input to zero then rescales the input such that the output goes linearly between minimum and 100% for an input that goes from 0 to 100%. Note these constraints: min >= 0, input >= 0, max = 100%.



Motor Data In this function block you enter the details of the motor under control and any available motor nameplate information. The Autotune feature will determine the Mag Current, Stator Resistance, Leakage Inductance, Mutual Inductance and Rotor Time Constant motor model parameters. The Overload parameter determines the allowed level of motor overload. This can be useful when operating with motors smaller than the inverter rating.

Motor Data

[1157]	Control Mode
[1158]	Power
[1159]	Base Frequency
[1160]	Motor Voltage
[64]	Motor Current
[65]	MAG Current
[83]	Nameplate RPM
[124]	Motor Connection
[84]	Motor Poles
[242]	Power Factor
[1164]	Overload
[119]	Stator RES
[120]	Leakage INDUC
[121]	Mutual INDUC
[1163]	Rotor Time CONST

Parameter Descriptions

Control Mode

Sets the main method of motor control.

Range: 0 : Volts / Hz
1 : Sensorless VEC
2 : Closed-loop VEC

Power

Sets the motor nameplate power. (1hp=0.746kW)

Range: 0.00 to 355.00kW

Base Frequency

Sets the motor nameplate base frequency.

Range: 7.5 to 500.0Hz

Motor Voltage

Sets the motor nameplate voltage at base frequency.

Range: 0.0 to 575.0V

Motor Current

Sets the motor nameplate full-load line current.

Range: 0.00 to 595.00A

MAG Current

Sets the motor model no-load line current as determined by Autotune.

Range: 0.00 to 595.00A

Nameplate RPM

Sets the motor nameplate full-load rated speed. This is the motor speed in RPM at base frequency minus full load slip.

Range: 0.0 to 32000.0 RPM

Motor Connection

Sets the motor nameplate connection method.

Range: 0 : Delta
1 : Star

Motor Data Continued

Parameter Descriptions

Motor Poles

Sets the motor nameplate pole pairs.

Range: 0 : 2 pole
1 : 4 pole
2 : 6 pole
3 : 8 pole
4 : 10 pole
5 : 12 pole

Power Factor

Sets the motor nameplate full-load power factor.

Range: 0.50 to 0.99

Overload

Sets the allowable motor overload factor. Matches the control current measurement range to the motor. The Motor Current x Overload is measured up to a maximum of 2 x constant torque current rating. The Overload parameter has no effect on the current, inverse time or torque limits.

Range: 1.0 to 5.0

Stator RES

Sets the motor model per-phase stator resistance as determined by Autotune.

Range: 0.00 to 250.00 Ohm

Leakage INDUC

Sets the motor model per-phase leakage inductance as determined by Autotune.

Range: 0.0 to 300.0 mH

Mutual INDUC

Sets the motor model per-phase mutual inductance as determined by Autotune.

Range: 0.0 to 3000.0 mH

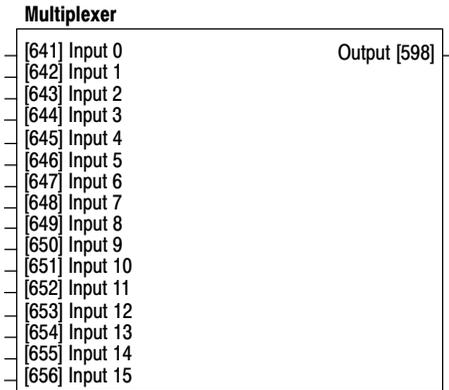
Rotor Time CONST

Sets the motor model rotor time constant as determined by Autotune.

Range: 10.00 to 3000.00

Multiplexer

Creates a 16 bit word from its 16 Boolean inputs. Also see Demultiplexer.



Parameter Descriptions

Output

The resulting 16 bit word.

Range: 0000 to FFFF

Input 0 – Input 15

16 Boolean inputs.

Range: 0 : False
1 : True

OP Station (Keypad)

The keypad block allows the control keys to be enabled or disabled.

Keypad

[300] Remote COMMS SEL COMMS SEQ [295]

Parameter Descriptions

OP VERSION (Output)

Displays the version of keypad software. It is set to 0000 if no keypad is present.

Range: 0000 to FFFF

Enabled Keys

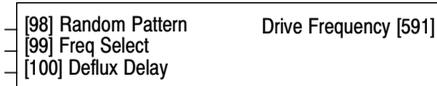
The following keys can be enabled or disabled individually.

Range: 0000 to FFFF

Parameter Value	Run	L/R	JOG	DIR
0000	-	-	-	-
0010	-	-	-	Enabled
0020	-	-	Enabled	-
0030	-	-	Enabled	Enabled
0040	-	Enabled	-	-
0050	-	Enabled	-	Enabled
0060	-	Enabled	Enabled	-
0070	-	Enabled	Enabled	Enabled
0080	Enabled	-	-	-
0090	Enabled	-	-	Enabled
00A0	Enabled	-	Enabled	-
00B0	Enabled	-	Enabled	Enabled
00C0	Enabled	Enabled	-	-
00D0	Enabled	Enabled	-	Enabled
00E0	Enabled	Enabled	Enabled	-
00F0	Enabled	Enabled	Enabled	Enabled

Pattern GEN The Pattern generator allows adjustment of the PWM (Pulse Width Modulator) operation. Quiet mode (Random Pattern=True) reduces audible motor noise to a dull hiss. The PWM carrier frequency may also be set as desired. This sets up the main switching frequency of the power output stage. A high setting of carrier frequency (e.g. 6kHz) reduces audible motor noise but only at the expense of higher Inverter losses and smooth motor rotation at low output frequencies. A low setting of carrier frequency (e.g. 3kHz), reduces Inverter losses but may increase audible motor noise.

Pattern GEN



Parameter Descriptions

Drive Frequency (Output)
The PWM output frequency.

Range: x.x Hz

Random Pattern

True selects random pattern (quiet motor noise),
False selects fixed carrier PWM.

Range: 0 : False
1 : True

FREQ Select

Sets the base switching frequency of the output stage. 3kHz reduces power losses but increases audible motor noise.

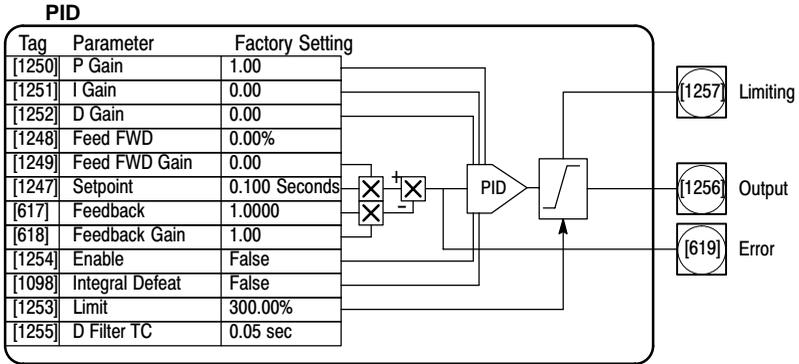
Range: 0 : 3 kHz
1 : 6 kHz

Deflux Delay

The minimum allowed delay between disabling and then re-enabling PWM generator (i.e. stopping and starting the drive).

Range: 0.1 to 10.0 sec

PID Used in applications requiring a trim to the setpoint, depending on feedback from an external measurement device. Typically for process control, i.e. pressure or flow. For an application that requires closed loop control, the error term may be derived from the setpoint and feedback using a value function block. This error term is then used by the PID. The output of the PID may be used to trim the demand setpoint (the Speed Trim parameter in the Reference function block).



Parameter Descriptions

- Output** (Output) Range: x.xx %
The output of the PID function.
- Error** (Output) Range: x.xx %
(Setpoint–Feedback) clamped to between ±100.00%.
- Limiting** (Output) Range: 0 : False
1 : True
When True, the Output is at the Limit value.
- P Gain** Range: 0.0 to 100.0
The true proportional gain of the PID controller. If P Gain=0, the PID output is zero.
- I Gain** Range: 0.01 to 100.00 sec
The integral time constant of the PID controller.
- D Gain** Range: 0.01 to 10.00 sec
The derivative time constant of the PID controller.
- Feed FWD** Range: –300.00 to 300.00 %
Feed forward input to the PID controller.
- Feed FWD Gain** Range: –300.00 to 300.00
Sets the Feed forward gain of the PID controller.
- Setpoint** Range: –300.00 to 300.00 %
The setpoint input to the PID controller.

PID Continued

Parameter Descriptions

Feedback

The feedback input to the PID controller.

Range: -300.00 to 300.00 %

Feedback Gain

Sets the Feedback gain of the PID controller.

Range: -300.00 to 300.00

Enable

TRUE allows the PIDcontroller to operate.

False, resets the PID output and integral term.

Range: 0 : False

1 : True

Integral Defeat

True resets the PID integral term.

Range: 0 : False

1 : True

Limit

Sets the maximum positive and negative levels (Limit) of the PID output.

Range: 0.00 to 300.00%

D Filter TC

The derivative time constant of the PID controller.

Range: 0.000 to 10.000 sec

Position The Position function block counts the encoder position from reset. The output will count 4 x the number of lines on the encoder per revolution.



Parameter Descriptions

Output

The number of encoder counts since the last reset.
The output is preserved during power-down.

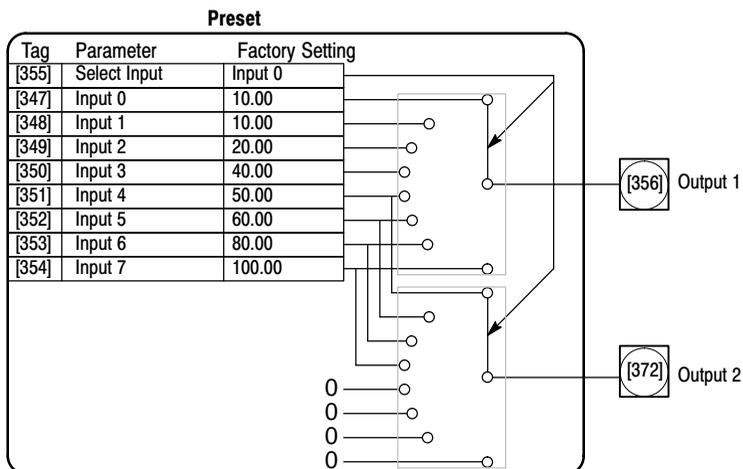
Range: x

Reset

True resets the position count to zero.

Range: 0 : False
1 : True

Preset Selects an output value from one of eight inputs, depends on the value of the Select Input. A second output is provided to allow a choice of two banks of eight values.



Parameter Descriptions

Output 1

Output = selected input.

Range: x.xx

Output 2

Output = selected input (if selected input range is).

Range: x.xx

Select Input

Selects which input is connected to Output 1. If Select Input is in the range 0 to 3, Input 4 to 7 is connected to Output 2, otherwise Output 2=0.

(If Select Input = 0; Output 1=Input 0, Output 2=Input 4.

If Select Input = 1; Output 1=Input 1, Output 2=Input 5 etc.)

Range: 0 : INPUT 0

1 : INPUT 1

2 : INPUT 2

3 : INPUT 3

4 : INPUT 4

5 : INPUT 5

6 : INPUT 6

7 : INPUT 7

Input 0 – 7

Inputs to the Preset block.

Range: -300.00 to 300.00

Raise Lower Provides a electronic potentiometer (EPOT) function. The Output is preserved during the power down. The table describes how Output is controlled by the Raise Input, Lower Input and Reset inputs.

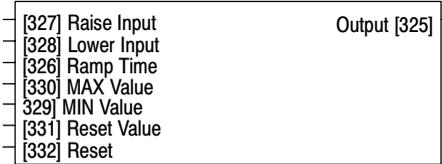
Note: If Output is greater than MAX Value the Output will ramp down to MAX Value at Ramp Time. If Output is less than MIN Value the Output will ramp up to MIN Value at Ramp Time.

Reset	Raise Input	Lower Input	Action
True	True/False	True/False	Output equals Reset Value
False	True	False	Output ramps up to MAX Value during Ramp Time
False	False	True	Output ramps down to MIN Value during Ramp Time
False	False	False	* Output is unchanged
False	True	True	* Output is unchanged

* If Output is greater than MAX Value the Output will ramp down to MAX Value during Ramp Time. If OUTPUT is less than MIN VALUE the OUTPUT will ramp up to MIN Value during Ramp Time.

Note: If MAX Value is less than or equal to MIN Value, the Output is set to MAX Value.

Raise/Lower



Parameter Descriptions

Output

The ramped output. The output is preserved during power-down.

Range: x.xx%

Raise Input

When True causes Output to ramp up.

Range: 0 : False
1 : True

Lower Input

When True causes Output to ramp down.

Range: 0 : False
1 : True

Ramp Time

Rate of change of the Output. The time to change from 0.00% to 100.00%. Note that the raise and lower rates are always the equal.

Range: 0.0 to 600.0 sec

MAX Value

The maximum value to which Output will ramp.

Range: -300.00 to 300.00 %

MIN Value

The minimum value to which Output will ramp.

Range: -300.00 to 300.00 %

Reset Value

The value of the Output when Reset is True.

Range: -300.00 to 300.00 %

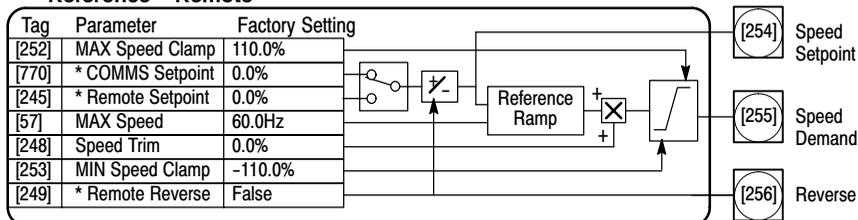
Reset

When True, forces Output to the Reset Value.

Range: 0 : False
1 : True

Reference Sets the parameters for the Local and Remote generation of the setpoint reference.

Reference – Remote

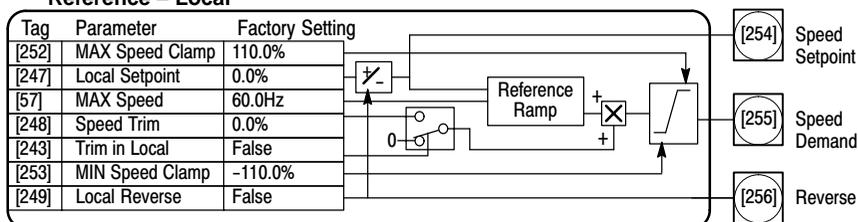


* Set only from Comms using tag 269 (readable as tag 770 in block diagram)

Remote Setpoint if Remote Reference Terminal mode

Comms Setpoint if Remote Reference mode (Mode is selectable in COMMS Control block)

Reference – Local



Parameter Descriptions

Speed Demand (Output)

Indicates the actual speed demand.

Range: x.x %

Speed Setpoint (Output)

Indicates target speed. This is equal to (one): Local Setpoint, Remote Setpoint, Jog Setpoint or Comms Setpoint. (Also see Reference Jog).

Range: x.x %

Reverse (Output)

Indicates demanded direction. This may not be the actual direction.

Range: 0 : False
1 : True

COMMS Setpoint

The target reference that the control will ramp to in Remote Reference Comms mode (not including trim). The direction is always positive, i.e. forward.

Range: x.xx %

Remote Setpoint

The target reference that the control will ramp to in Remote Reference mode (not including trim). Direction depends on Remote Reverse and the sign of Remote Setpoint.

Range: -300.00 to 300.00 %

Speed Trim

The trim is added to the ramp output in remote mode (or if Trim in Local is True) to form Speed Demand.

Range: -300.00 to 300.00 %

Reference Continued

Parameter Descriptions

MAX Speed

Maximum commanded speed allowed.

Range: 7.5 to 240 Hz

MAX Speed Clamp

Maximum value for Speed Demand output.

Range: 0.00 to 110.00 %

MIN Speed Clamp

Minimum value for Speed Demand output.

Range: -110.00 to 0.00 %

Trim in Local

True, Speed Trim is always added to the ramp output.
False, Speed Trim is added only to Remote mode.

Range: 0 : False
1 : True

Remote Reverse

Demanded direction in Remote Reference mode.
Normally connected to the Sequencing Logic.

Range: : False
1 : True

Local Setpoint

Setpoint set at Keypad. Always a positive value and
is saved on power down. Direction is taken from
Local Reverse.

Range: 0.00 %

Reference Jog Sets the parameters for the Jog function.

Reference Jog

[246]	Setpoint
[261]	Accel Time
[262]	Decel Time

Parameter Descriptions

Setpoint

The reference speed the control will ramp to.

Range: -100.00 to 100.00 %

Accel Time

The acceleration time for Jog mode.

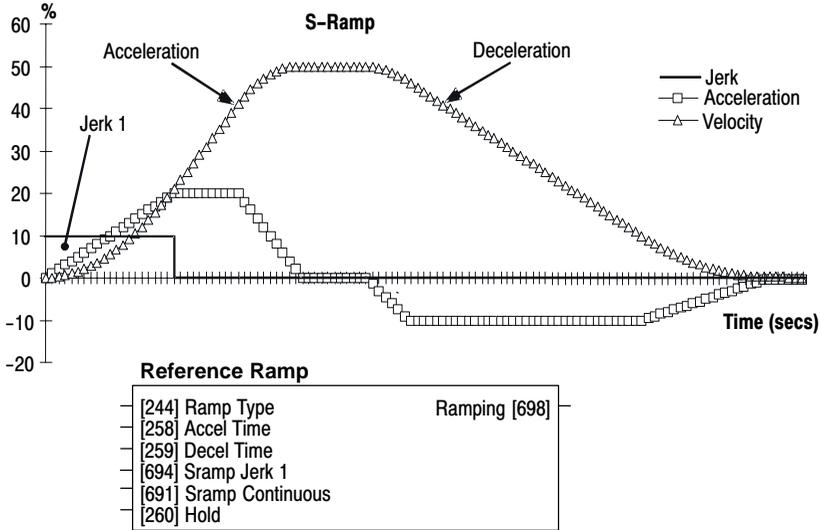
Range: 0.0 to 3000.0 sec

Decel Time

The deceleration time for Jog mode.

Range: 0.0 to 3000.0 sec

Reference Ramp Sets the parameters that control the output ramp's rate of change in response to a change in demand.



Parameter Descriptions

Ramping (Output)

Set True when ramping is active.

Range: 0 : False
1 : True

Ramp Type

Sets Linear or S type ramp.

Range: 0 : LINEAR
1 : S

Accel Time

The time to ramp from 0.00% to 100.00%.

Range: 0.0 to 3000.0 sec

Decel Time

The time to ramp from 100.00% to 0.00%.

Range: 0.0 to 3000.0 sec

SRamp Jerk 1

Rate of change of acceleration for the first segment of the curve in units per second³. (Example, if full machine speed is 1.25m/s the acceleration will be: 1.25 x 50.00% = 0.625m/s³)

Range: 0.00 to 100.00 %

SRamp Continuous

False causes an immediate transition from the old curve to the new curve. True causes a smooth transition. If the speed setpoint is changed when ramping (if Ramp Type = Sramp). The curve is controlled by Sramp Accel and Sramp Jerk 1.

Range: 0 : False
1 : True

Hold

When TRUE, the last value of the output is held.

Range: 0 : False
1 : True

Reference Stop Sets the stopping method parameters.

Reference Stop

- [279] Run Stop Mode
- [263] Stop Time
- [266] Stop Zero Speed
- [284] Stop Delay
- [304] Fast Stop Mode
- [275] Fast Stop Limit
- [264] Fast Stop Time
- [126] Final Stop Rate

Parameter Descriptions

Run Stop Mode

Sets the stop mode. Used when run command is removed. Ramped stop mode uses Reference Ramp Decel Time. Coast mode allows the motor will free-wheel. DC Injection stops the motor by injecting DC current.

Range: 0 : Ramped
1 : Coast
2 : DC Injection

Stop Time

Rate at which the Speed Demand is ramped to zero after the ramp is quenched.

Range: 0.0 to 600.0 sec

Stop Zero Speed

Threshold for zero speed detection.

Range: 0.00 to 100.00 %

Stop Delay

The time that zero speed is held before quenching (after a normal stop or a Jog stop). Useful if a mechanical brake requires time to operate at zero speed, or for jogging a machine to position.

Range: 0.000 to 30.000 sec

Fast Stop Mode

Selects stopping mode used during a fast stop.

Range: 0 : Ramped
1 : Coast

Fast Stop Limit

Maximum time the control will try to Fast Stop before quenching.

Range: 0.0 to 3000.0 sec

Fast Stop Time

Rate at which the Speed Demand is ramped to zero.

Range: 0.0 to 600.0 sec

Final Stop Rate

Rate at which any internally generated setpoint trims are removed. For example, the trim due to the slip compensation block.

Range: 12 to 4800 Hz/s

Sequencing Logic Controls the sequencing (start and stop) of the control. Before the control will respond to the Run Fwd, Run Rev or Jog parameters, the parameters Drive Enable, Not Fast Stop and Not Coast Stop must be set to True. In addition, the Inverter needs to be healthy (Healthy is True). The Inverter will only respond to Run Fwd, Run Rev and Jog if the Inverter is in the Remote Sequencing mode. If Run Fwd and Run Rev are True, both are ignored and the Inverter will stop.

COMMS Control

[291] Run Forward	Tripped [289]
[292] Run Reverse	Running [285]
[293] Not Stop	Jogging [302]
[280] Jog	Stopping [303]
[1235] Contactor Closed	Output Contactor [286]
[276] Drive Enable	Switch on Enable [288]
[277] Not Fast Stop	Switched On [306]
[278] Not Coast Stop	Ready [287]
[294] Remote Reverse	System Reset [305]
[282] REM Trip Reset	Sequencer State [301]
[290] Trip RST by Run	Remote Rev Out [296]
[283] Power Up Start	Healthy [274]

Parameter Descriptions

- Tripped** (Output) Range: 0 : False
True indicates a latched trip is present. 1 : True
- Running** (Output) Range: 0 : False
True indicates the control is enabled. 1 : True
- Jogging** (Output) Range: 0 : False
True indicates the control is in JOG mode. 1 : True
- Stopping** (Output) Range: 0 : False
True indicates the control is stopping. 1 : True
- Output Contactor** (Output) Range: 0 : False
Output to drive an external motor contactor. This 1 : True
contactor is normally closed.
- Switch On Enable** (Output) Range: 0 : False
Indicates the control is ready to accept a run 1 : True
command.
- Switched On** (Output) Range: 0 : False
Run accepted. Waiting for Contactor Closed. 1 : True
- Ready** (Output) Range: 0 : False
True indicates the control is ready and will run if 1 : True
enabled.
- System Reset** (Output) Range: 0 : False
True for a single execution cycle after the control 1 : True
enters either Run or Jog mode.

Sequencing Logic Continued

Parameter Descriptions

Sequencer State (Output)

Indicates the current state of the sequencer:

Range: 0 : START
DISABLED
1 : START ENABLED
2 : SWITCHED ON
3 : READY
4 : ENABLED
5 : F-STOP ACTIVE
6 : TRIP ACTIVE
7 : TRIPPED

Remote Rev Out (Output)

True indicates a remote demand to Run REV (Remote Reverse and Run Reverse inputs active.)

Range: 0 : False
1 : True

Healthy (Output)

Set False when a trip occurs, and set True when the run command is removed.

Range: 0 : False
1 : True

Run Forward

True causes the control to run in the forward direction if enabled.

Range: 0 : False
1 : True

Run Reverse

True causes the control to run in the reverse direction if enabled.

Range: 0 : False
1 : True

Not Stop

True will latch the Run FWD or Run REV command. Once latched, the run command can be reset to False and the control will continue to run. False causes the run commands to be unlatched.

Range: 0 : False
1 : True

Jog

True causes the control to run at Jog speed (Jog Setpoint in the Reference Jog block). False causes a ramp to zero stop.

Range: 0 : False
1 : True

Contactors Closed

Feedback to indicate the external contactor is closed. It must be True for the sequencer to proceed from the Switched On state to the Ready State, refer to Sequencer State.

Range: 0 : False
1 : True

Drive Enable

False disables the control and the motor will coast to a stop if running.

Range: 0 : False
1 : True

Sequencing Logic Continued

Parameter Descriptions

Not Fast Stop

False causes a ramp to zero stop if the motor is running. The ramp rate is set by Fast Stop Rate in the Stop block.

True is a latched condition. The control cannot be restarted until fast stop is complete.

Range: 0 : False
1 : True

Not Coast Stop

False disables the control and the motor will coast to a stop if running.

True is a latched condition. The control cannot be restarted until coast stop is complete.

Range: 0 : False
1 : True

Remote Reverse (for remote setpoints)

True inverts the demanded rotation direction.

Range: 0 : False
1 : True

REM Trip Reset

False to True transition clears the latched trips.

Range: 0 : False
1 : True

Trip RST by Run

Allows the rising edge of a run command to clear latched trips.

Range: 0 : False
1 : True

Power Up Start

True allows the control to run if in remote and a run command is present.

False requires a low to high run command transition.

Range: 0 : False
1 : True

Skip Frequencies Useful to prevent the operation at frequencies that cause mechanical resonance in the load. For example, if Frequency 1 is set to 20Hz and Band 1 is set to 10Hz, continuous operation is not allowed in the dead band of 15Hz to 25Hz. The skip frequencies are symmetrical and work in forward and reverse directions.

Note: Setting the Frequency to 0 disables the corresponding band.
 Setting the Band to 0 causes the value of Band 1 to be used for this band.

Skip Frequencies



Parameter Descriptions

Output

The output of the function block in Hz.

Range: x.x Hz

Input

The value of the block input in %.

Range: -300.00 to 300.00 %

Band 1 (Band 2)

The width of the skip band centered about the skip frequency (Frequency 1 or 2).

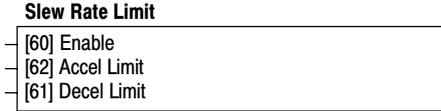
Range: 0.0 to 480.0 Hz

Frequency 1 (Frequency 2)

The center frequency of the skip band to skip or treat as a dead band.

Range: 0.0 to 480.0 Hz

Slew Rate Limit Prevents over-current and over-voltage faults during a rapidly changing setpoint. When the braking block determines that the internal dc link voltage is too high it issues a Hold signal. This causes the Slew Rate Limit block to hold the setpoint at its current value. This typically lasts for only 1ms to allow the excess energy to be dumped into the braking resistor.



Parameter Descriptions

Enable

False disables the function block.

Range: 0 : False

1 : True

Accel Limit

The maximum allowed rate at which the setpoint may accelerate from zero.

Range: 1.0 to 1200.0 Hz/

Decel Limit

The maximum allowed rate at which the setpoint may decelerate towards zero.

Range: 1.0 to 1200.0 Hz/

Slip Comp Allows the control to maintain motor speed in the presence of load disturbances. Based on the rated speed, the no load speed and the rated load of the motor, the slip compensation block adjusts the demand frequency to compensate for any speed slippage due to the load.

Slip Comp

- [82] Enable
- [85] Motoring Limit
- [86] Regen Limit

Parameter Descriptions

Enable

True allows slip compensation operation.

Range: 0 : False

1 : True

Motoring Limit

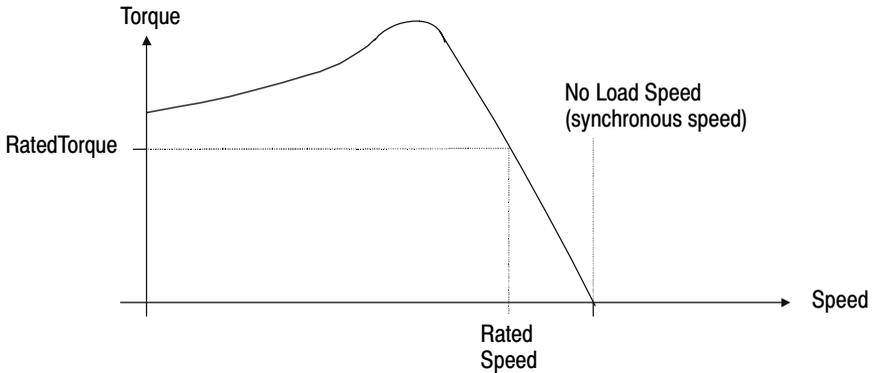
The maximum trim produced by the slip compensation block when the motor is driving the load (motoring).

Range: 0.0 to 600.0 RPM

Regen Limit

The maximum trim produced by the slip compensation block when the motor is being driven by the load, (regenerating).

Range: 0.0 to 600.0 RPM



Speed Loop For Sensorless Vector and Closed Loop Vector modes only. Controls the motor speed by comparing the actual speed to the demanded speed, and applying more or less torque in response to the error.

Fixed Inputs and Outputs Speed Demand

This is connected to the output of the Setpoint Scale function block.

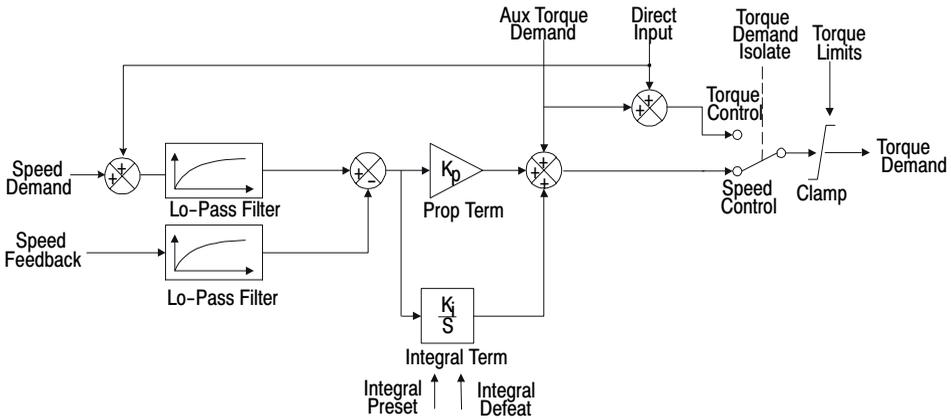
Speed Feedback

Calculated from the voltages and currents in Sensorless Vector.

Torque Demand

The output of the Speed Loop function block is a torque demand. This torque demand is passed on to the Torque Limit function block, which causes the torque to be generated in the motor.

The speed error ($Speed_{demand} - Speed_{fdbk}$) is processed by the proportional + integral (PI) controller. The output is a torque demand to the torque control block. Speed demand is derived from the Setpoint Scale block. In Sensorless VEC mode, speed feedback is calculated from motor voltages and currents.



Speed Loop

[1187] Speed PROP Gain	Total SPD DMD RPM [1203]
[1188] Speed INT Time	Total SPD DMD% [1206]
[1189] INT Defeat	Speed Error [1207]
[1190] Speed INT Preset	Torque Demand [1204]
[1191] Speed DMD Filter	
[1192] Speed FBK Filter	
[1193] AUX Torque DMD	
[1200] Speed POS LIM	
[1201] Speed NEG LIM	
[1202] TORQ CTRL Mode	

Speed Loop Continued

Parameter Descriptions

Total SPD DMD RPM (Output) The final value of the speed demand obtained after summing all sources. This is the value which is presented to the speed loop.	Range: x.xx RPM
Total SPD DMD % (Output) The final values of the speed demand obtained after summing all sources. This is the value which is presented to the speed loop.	Range: x.xx %
Speed Error (Output) The difference between the demanded speed and the actual speed.	Range: x.xx %
Torque Demand (Output) The motor torque demand as a percentage of rated motor torque.	Range: x.xx %
Speed PROP Gain Sets the proportional gain of the loop. Speed error (revolutions per second) x proportional gain = torque percent.	Range: 0.00 to 300.00
Speed INT Time The integral time constant of the speed loop. A speed error which causes the proportional term to produce a torque demand T, will cause the integral term to also ramp up to a torque demand T after a time equal to Speed INT Time.	Range: 1 to 15000 ms
INT Defeat When True, the integral term does not operate.	Range: 0 : False 1 : True
Speed INT Preset The integral term will be preset to this value when the drive starts.	Range: -500.00 to 500.00 %
Speed DMD Filter Filters the speed demand to reduce ripple. The filter is first order with time constant equal to the value of this parameter.	Range: 0.0 to 14.0 ms
Speed FBK Filter Filters the speed feedback to reduce ripple (caused by low line count encoders). The filter is first order with time constant equal to the value of this parameter.	Range: 0.0 to 15.0 ms
AUX Torque DMD In speed control mode, this value is added to the torque demand produced by the speed loop PI. In torque control mode (i.e. Torq CTRL Mode is True) the speed loop PI does not operate.	Range: -300.00 to 300.00 %
Speed POS LIM Sets the upper limit of the speed demand.	Range: -110.00 to 110.00 %
Speed NEG LIM Sets the lower limit of the speed demand.	Range: -110.00 to 110.00 %
TORQ CTRL Mode Determines if operation is in Speed control or Torque control mode.	Range: 0 : False 1 : True

Stabilization Reduces unstable operation in induction motors typically observed at half full speed, and under low load conditions.

Stabilization

[128] Enable

Parameter Descriptions

Enable

True enables the stabilization function.

Range: 0 : False
1 : True

Stall Trip Protects the motor from damage due to continuous operation beyond specification. If the estimated load exceeds the Stall Limit for a time greater than Stall Time then the stall trip will become active. The timer is reset whenever the estimated load is less than the Stall Limit.

Stall Trip

[2400] Stall Limit
[241] Stall Time

Parameter Descriptions

Stall Limit

The load limit beyond which the stall trip monitoring becomes active.

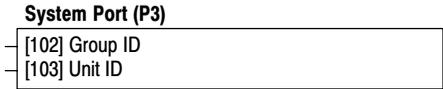
Range: 50.00 to 150.00 %

Stall Time

The time after which a stall condition will cause a trip.

Range: 0.1 to 3000.0 sec

System Port (P3) The unisolated RS232 programming port(s) allows for connection to the keypad (OP Station) or to a PC for drive configuration and storage of parameters. The port uses a BISYNCH ASCII protocol. The control will always respond to GID = 0 and UID = 0, as this used by the keypad.



Parameter Descriptions

- Group ID (GID)** Range: 0 to 9
The protocol group identity address.
- Unit ID (UID)** Range: 0 to 15
The protocol unit identity address.

Torque Limit Allows you to set the maximum motor rated torque before torque limit action occurs. If the estimated motor torque is greater than the Actual POS LIM value, the motor speed is controlled to maintain the torque at this level. A similar situation occurs if the estimated motor torque is less than the Actual NEG LIM value. Separate positive and negative torque limits as well as a symmetric main torque limit are provided. The smallest positive and negative torque limits (including any current limit or inverse time current limit action) is indicated in the Actual POS LIM and Actual NEG LIM diagnostic. These are the final limits for motor torque.

Torque Limit

[1208] POS Torque LIM	Actual POS LIM [1212]
[1209] NEG Torque LIM	Actual NEG LIM [1213]
[1210] Main Torque LIM	
[1211] Symmetric LIM	
[1554] Fast Stop T-LIM	

Parameter Descriptions

Actual POS LIM (Output)

The final actual positive torque limit including any current limit or inverse time current limit action.

Range: x.xx %

Actual NEG LIM (Output)

The final actual negative torque limit including any current limit or inverse time current limit action.

Range: x.xx %

POS Torque LIM

Sets the maximum allowed of positive motor torque.

Range: -300.00 to 300.00 %

NEG Torque LIM

Sets the maximum allowed of negative motor torque.

Range: -300.00 to 300.00 %

Main Torque LIM

Sets the maximum allowed symmetric motor torque limit.

Range: 0.00 to 300.00 %

Symmetric LIM

True forces the NEG Torque LIM to the same value as the POS Torque LIM parameter.

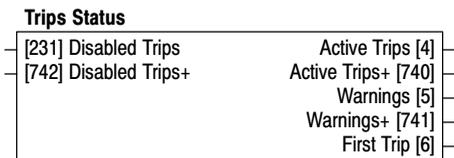
Range: 0 : False
1 : True

Fast Stop T-LIM

Sets the torque limit used during a Fast Stop.

Range: 0.00 to 300.00 %

Trips Status The Inverter supports advanced and flexible trip logic to support monitoring of the Inverter itself, the motor and the load. This function block provides a view into the current trip condition(s) and allows some trips to be disabled.



Parameter Descriptions

Active Trips and Active Trips+ (Output) Range: 0000 to FFFF
 Indicates which trips are currently active. These parameters are a coded representation of the trip status.

Warnings and Warnings+ (Output) Range: 0000 to FFFF
 Indicates which conditions are likely to cause a trip. These parameters are a coded representation of the warning status.

First Trip (Output) Range: 0 to 45
 When a trip occurs until that trip is reset, this parameter indicates the trip source. When several trips have occurred, this parameter indicates the first trip that was detected.

Disabled Trips and Disabled Trips+ Range: 0000 to FFFF
 Indicates which trips have been disabled. Not all trips may be disabled. The Disabled Trips mask is ignored for trips that cannot be disabled. Table D-1 is provided to describe how this parameter is formed.

Hexadecimal Representation of Trips

When more than one trip is to be represented at the same time, the Hex trip codes are simply added together to form the value displayed. Within each digit, values between 10 and 15 are displayed as letters A to F. Example, the Active Trips parameter is 02A8, this represents:

- “2” in digit 3
- “8” and a “2” in digit 2 (8+2 = 10, displayed as A)
- “8” in digit 1

Active Trips can represent the active trips Brake Resistor, Motor Stalled, Input 1 Break and Heatsink Temp, (an unlikely situation).

Active Trips+ can represent Current Limit, Desat (Over I), Trip 22 and 24V failure, (another unlikely situation).

Note: The hexadecimal value is used over comms, however, pressing the M key (keypad) when displaying the hexadecimal trip value will show the list of all trips and their current values.

Trips Status Continued

Table D-1 Trip Identification

Trip Name (MMI)	Value	Mask	User Disable	Auto-restart
NO TRIP	0	0x0000	N/A	N/A
OVERVOLTAGE	1	0x0001	No	Yes
UNDERVOLTAGE	2	0x0002	No	Yes
OVERCURRENT	3	0x0004	No	Yes
HEATSINK	4	0x0008	No	Yes
EXTERNAL TRIP	5	0x0010	No	Yes
INPUT 1 BREAK	6	0x0020	Yes	Yes
INPUT 2 BREAK	7	0x0040	Yes	Yes
MOTOR STALLED	8	0x0080	Yes	Yes
TRIP 9 (Reserved)	9	0x0100	No	No
BRAKE RESISTOR	10	0x0200	Yes	Yes
BRAKE SWITCH	11	0x0400	Yes	Yes
OP STATION	12	0x0800	Yes	Yes
LOST COMMS	13	0x1000	Yes	Yes
CONTACTOR FBK	14	0x2000	Yes	Yes
SPEED FEEDBACK	15	0x4000	Yes	Yes
AMBIENT TEMP	16	0x8000	No	Yes
MOTOR OVERTEMP	17	0x0001	Yes	Yes
CURRENT LIMIT	18	0x0002	No	Yes
TRIP 19 (Reserved)	19	0x0004	No	No
24V FAILURE	20	0x0008	Yes	Yes
LOW SPEED OVER I	21	0x0010	No	Yes
TRIP 22 (Reserved)	22	0x0020	No	No
ENCODER 1 FAULT	23	0x0040	Yes	Yes
DESAT (OVER I)	24	0x0080	No	Yes
VDC RIPPLE	25	0x0100	No	Yes
BRAKE SHORT CCT	26	0x0200	No	Yes
OVERSPEED	27	0x0400	Yes	Yes
TRIP 28 (Reserved)	28	0x0800	No	No
TRIP 29 (Reserved)	29	0x1000	No	No
TRIP 30 (Reserved)	30	0x2000	No	No
UNKNOWN	31	0x4000	No	Yes
OTHER	32	0x8000	No	Yes
MAX SPEED LOW	33	0x8000	N/A	N/A
MAINS VOLTS LOW	34	0x8000	N/A	N/A
NOT AT SPEED	35	0x8000	N/A	N/A
MAG CURRENT FAIL	36	0x8000	N/A	N/A
NEGATIVE SLIP F	37	0x8000	N/A	N/A
TR TOO LARGE	38	0x8000	N/A	N/A
TR TOO SMALL	39	0x8000	N/A	N/A
MAX RPM DATA ERR	40	0x8000	N/A	N/A
STACK TRIP	41	0x8000	N/A	N/A
LEAKGE L TIMEOUT	42	0x8000	N/A	N/A
POWER LOSS STOP	43	0x0002	No	Yes

Value Function Each value function block can has three inputs and one output. Each may be configured to perform a logical expression on the inputs to produce an output value.

Value Func 1



Value Func 2



Value Func 3



Value Func 4



Parameter Descriptions

Output

The value after the selected function is performed.

Input A, Input B, Input C

General purpose digital input.

Type

The function to be performed on the three inputs to produce the output value.

Range: x.xx

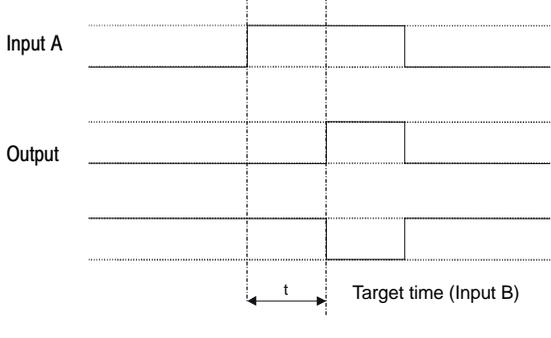
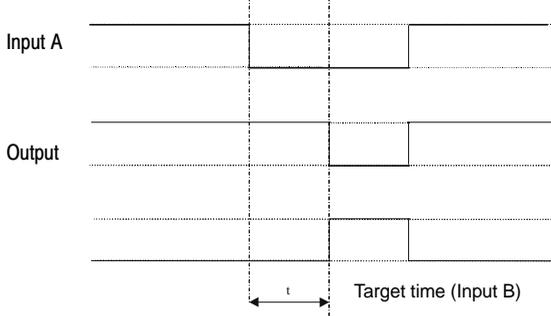
Range: -32768.00 to 32767.00

- Range: 0 : If(C) -a
- 1 : Abs(A+B+C)
 - 2 : Switch(A,B)
 - 3 : (A*B)/C
 - 4 : A+B+C
 - 5 : A-b-c
 - 6 : B<=A<=C
 - 7 : A>B+/-c
 - 8 : A>=B
 - 9 : Abs(A)>B+/-c
 - 10 : Abs(A)>=B
 - 11 : A(1+B)
 - 12 : If(C) Hold(A)
 - 13 : Binary Decode
 - 14 : On Delay
 - 15 : Off Delay
 - 16 : Timer
 - 17 : Minimum Pulse
 - 18 : Pulse Train
 - 19 : Window
 - 20 : Up/Dwn Counter
 - 21 : (A*B)/C Round
 - 22 : Window No Hyst

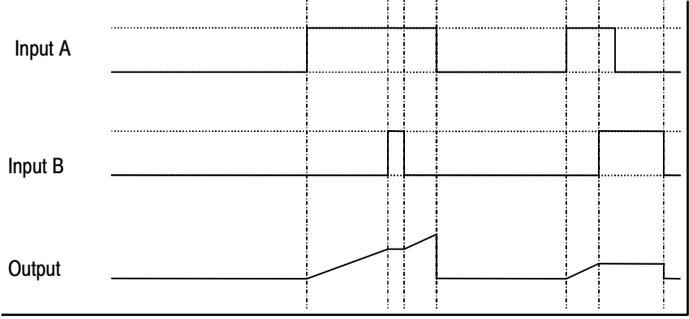
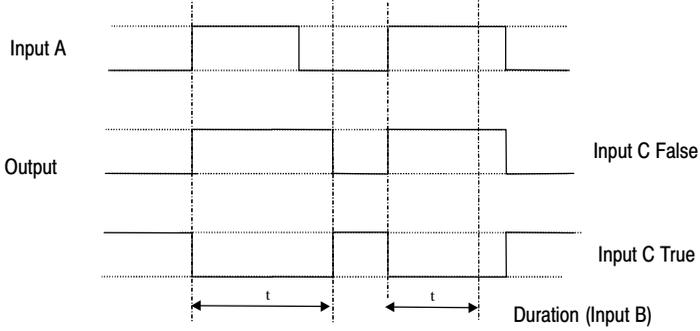
Value Function Continued

Function	Description																																				
IF(C) -A	If Input C is not zero, the Output is minus Input A, otherwise the Output is the same as Input A.																																				
ABS(A+B+C)	The Output is set to the absolute value of Input A + Input B + Input C.																																				
Switch(A,B)	<div style="display: flex; align-items: center;"> <div style="margin-right: 10px;"> Input A Input B Input C </div>  <div style="margin-left: 10px;"> Output </div> </div> <p>If Input C is zero the Output is set to Input A, otherwise the Output is set to Input B.</p>																																				
(A*B)/C	The Output is set to (Input A * Input B) / (Input C). The algorithm compensates for the remainder term.																																				
A+B+C	The Output is set to (Input A + Input B + Input C).																																				
A-B-C	The Output is set to (Input A - Input B - Input C).																																				
B<=A<=C	<div style="display: flex; align-items: center;"> <div style="margin-right: 10px;"> Input A Input B Input C </div>  <div style="margin-left: 10px;"> Output </div> </div> <p>The Output is set to the value of Input A, but cannot exceed the maximum value of Input C nor be less than the minimum value of Input B. If Input B > Input C the output is undefined.</p>																																				
A>B+/-C	<div style="display: flex; align-items: center;"> <div style="margin-right: 10px;"> Input A Input B Input C </div>  <div style="margin-left: 10px;"> Output </div> </div> <p>The Output is True if Input A is greater than Input B + Input C. The Output is False if Input A is less than Input B - Input C. Otherwise the Output is unchanged. In this way the block acts as a simple comparator with a comparison level of Input B and a hysteresis band equal to ± Input C.</p>																																				
A>=B	<div style="display: flex; align-items: center;"> <div style="margin-right: 10px;"> Input A Input B </div>  <div style="margin-left: 10px;"> Output </div> </div> <p>The Output is True if Input A is greater than or equal to Input B, otherwise the Output is False.</p>																																				
ABS(A)>B+/-C	<div style="display: flex; align-items: center;"> <div style="margin-right: 10px;"> Input A Input B Input C </div>  <div style="margin-left: 10px;"> Output </div> </div> <p>The OUTPUT is TRUE if the absolute value of A is greater than the absolute value of B +/- INPUT C. The OUTPUT is FALSE if the absolute value of A is less than or equal to the absolute value of B - INPUT C. Otherwise the OUTPUT is unchanged. In this way the block acts as a magnitude comparator with a comparison level of INPUT B and a hysteresis band equal to ± Input C.</p>																																				
ABS(A)>=B	<div style="display: flex; align-items: center;"> <div style="margin-right: 10px;"> Input A Input B </div>  <div style="margin-left: 10px;"> Output </div> </div> <p>The Output is True if the absolute value of A is greater than or equal to the absolute value of B, otherwise the Output is False.</p>																																				
A(1+B)	The OUTPUT is set to INPUT A + (INPUT A * INPUT B / 100.00).																																				
IF(C) Hold(A)	If INPUT C is zero, the OUTPUT is set to INPUT A, otherwise the OUTPUT is unchanged. On powering up the drive, the output is preset to the last saved value of input B.																																				
Binary Decode	<p>The OUTPUT is set according to which of the INPUTs are non-zero.</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>INPUT C</th> <th>INPUT B</th> <th>INPUT A</th> <th>OUTPUT</th> </tr> </thead> <tbody> <tr><td>0</td><td>0</td><td>0</td><td>0.00</td></tr> <tr><td>0</td><td>0</td><td>≠0</td><td>1.00</td></tr> <tr><td>0</td><td>≠0</td><td>0</td><td>2.00</td></tr> <tr><td>0</td><td>≠0</td><td>≠0</td><td>3.00</td></tr> <tr><td>≠0</td><td>0</td><td>0</td><td>4.00</td></tr> <tr><td>≠0</td><td>0</td><td>≠0</td><td>5.00</td></tr> <tr><td>≠0</td><td>≠0</td><td>0</td><td>6.00</td></tr> <tr><td>≠0</td><td>≠0</td><td>≠0</td><td>7.00</td></tr> </tbody> </table> <p>Note: ≠0 indicates that the corresponding input is not equal to zero.</p>	INPUT C	INPUT B	INPUT A	OUTPUT	0	0	0	0.00	0	0	≠0	1.00	0	≠0	0	2.00	0	≠0	≠0	3.00	≠0	0	0	4.00	≠0	0	≠0	5.00	≠0	≠0	0	6.00	≠0	≠0	≠0	7.00
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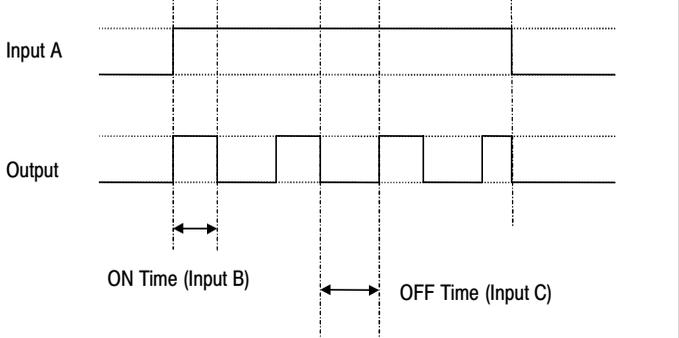
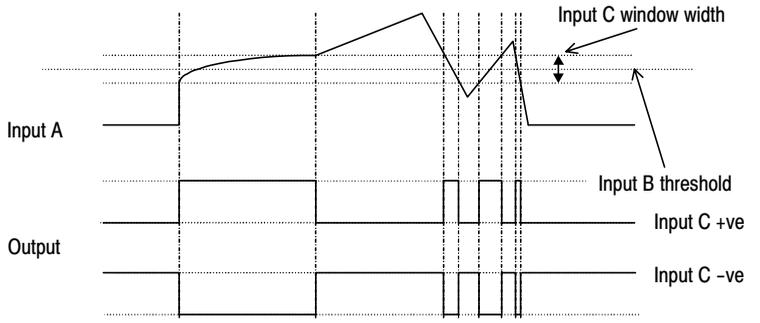
Value Function Continued

Function	Description
ON Delay	 <p data-bbox="297 568 1057 654">A programmable delay between receiving and outputting a Boolean TRUE signal. INPUT A becoming TRUE starts the delay timer. INPUT B sets the duration of the delay in seconds. At the end of the duration, OUTPUT becomes TRUE unless INPUT A has reverted to FALSE. Setting INPUT C to TRUE ($\neq 0$) inverts the output.</p>
OFF Delay	 <p data-bbox="297 1008 1057 1094">A programmable delay between receiving and outputting a Boolean FALSE signal. INPUT A becoming FALSE starts the delay timer. INPUT B sets the duration of the delay in seconds. Setting INPUT C to TRUE ($\neq 0$) inverts the output. At the end of the duration, OUTPUT becomes FALSE unless INPUT A has reverted to TRUE.</p>

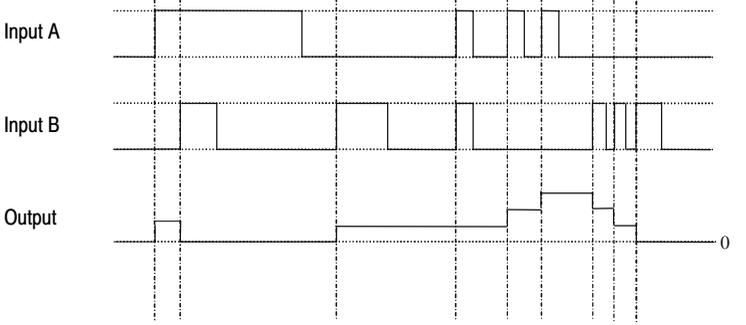
Value Function Continued

Function	Description
Timer	 <p data-bbox="238 608 986 715">Times the period elapsed from when INPUT A is set TRUE and held TRUE, to when INPUT B becomes TRUE. OUTPUT is the duration of the timer in seconds, starting from zero. If INPUT B is TRUE, the value for OUTPUT is held until INPUT B is released. If on release INPUT A is still TRUE, the timer will continue from the held value. Setting INPUT A and INPUT B to FALSE resets the timer. INPUT C is not used.</p>
Minimum Pulse	 <p data-bbox="238 1082 997 1166">Creates an output of adjustable minimum time when INPUT A is TRUE. (INPUT A is assumed to be a sequence of TRUE pulses and FALSE off periods.) INPUT B sets the length of the minimum pulse required in seconds. INPUT C inverts the output when TRUE. The duration of the pulse is at least the period set by INPUT B.</p>

Value Function Continued

Function	Description
Pulse Train	 <p data-bbox="297 568 1057 635">Creates a pulsed FALSE / TRUE output of programmable frequency. INPUT A enables the pulse train when TRUE, disables when FALSE. INPUT B sets the length of the on part of the pulse in seconds. INPUT C sets the length of the off part of the pulse in seconds.</p>
Window	 <p data-bbox="297 983 1057 1155">This function outputs TRUE when INPUT A is within a programmable range, and FALSE otherwise. INPUT B sets the threshold of the window to be monitored. INPUT C defines the range of the window around the threshold. When the value of INPUT A is inside the window, the window expands by 0.01 to avoid flutter on output if noisy, i.e. if INPUT B = 5 and INPUT C = 4 then the range is 3 to 7, expanded to 2.5 to 7.5 when the value if INPUT A is inside the window. If INPUT C is set to zero, the output will only be TRUE if INPUT A is exactly equal to INPUT B (this is fulfilled in the default condition when inputs A, B & C are all zero) If INPUT C is set to a negative value, its absolute value defines the window range, and the output is inverted.</p>

Value Function Continued

Function	Description
Up/DWN Counter	 <p>INPUT A provides a rising edge trigger to increment the output count by one. INPUT B provides a rising edge trigger to decrement the output count by one. INPUT C holds the output at zero. The output starts at zero. The output is limited at ± 300.00.</p>
(A*B)/C Round	The OUTPUT is set to $(\text{INPUT A} * \text{INPUT B}) / (\text{INPUT C})$. This is the same as (A*B)/C (Type 3) except that the result is rounded.
Window NO HYST	This is the same as WINDOW (Type 19) except that there is no hysteresis when inside the window. Thus, from the diagram given in WINDOW, if INPUT B = 5 and INPUT C = 4 then the range is 3 to 7.

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