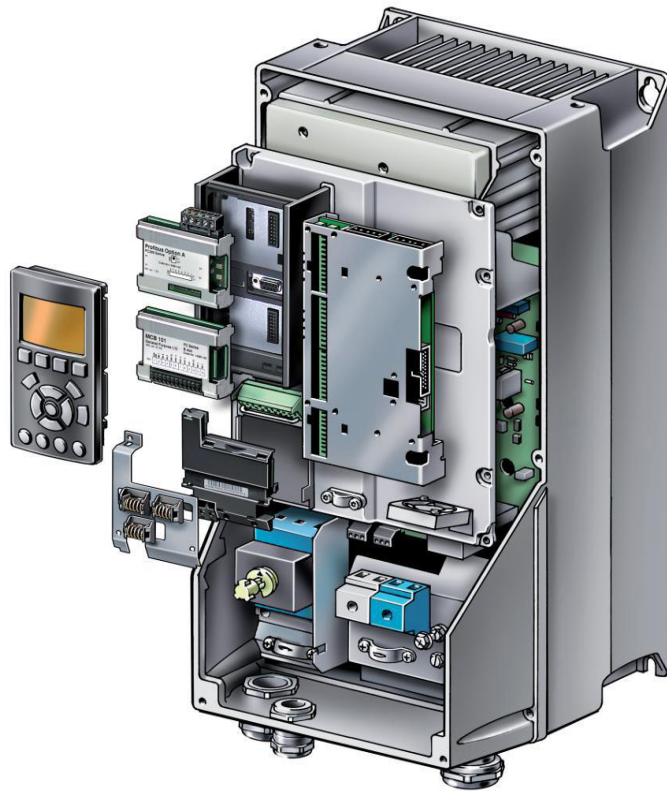




COMMERCIAL ACU DRIVE™ XS

VARIABLE FREQUENCY DRIVE



TECHNICAL HANDBOOK AND PROGRAMMING GUIDE

IMPORTANT SAFETY INSTRUCTIONS
READ AND FOLLOW ALL INSTRUCTIONS
SAVE THESE INSTRUCTIONS

CUSTOMER SERVICE / TECHNICAL SUPPORT

If you have questions about ordering, installation or need assistance with startup of the Acu Drive™ XS Variable Frequency Drive, please contact:

Pentair Customer Service and Technical Support:

Phone: (800) 831-7133

Website:

Visit www.pentaircommercial.com

For Direct Danfoss Technical Support: Phone: (800) 432-6367

Table of Contents

Section 1

Data collection and pre-site.....	1-2
Flow meter pre-site.....	3
Part Numbers and description.....	4-5
Enclosure options.....	6
Flow meter options and part numbers.....	7
Extended warranty.....	8

Section 2

Start-up check list.....	9-11
Start-up request sheet.....	12
Start-up programming parameters (facility provided).....	13

Section 3

Wire Diagram (single and three phase installations).....	14
Flow meter wire diagram.....	15
Flow meter to drive wire diagram.....	16
Jumper wire locations on drive terminal block.....	17

Section 4

Programming Display options.....	18-20
----------------------------------	-------

Section 5

Flow meter instructions.....	23
Flow meter installation.....	24
Flow meter programming.....	24-25
Flow meter menu.....	26-27
Average and sensitivity.....	28
K factors.....	29

TABLE OF CONTENTS (CONT.)

Section 6

Keypad functions.....30

Smart Start Speed.....31

Single Speed32-33

Speed / Automation.....34-35

Speed / Schedule.....36-37

Section 7

Smart Start Flow.....38

Flow Single setpoint39-40

Flow / Automation.....41-42

Flow / Schedule.....43-44

Section 8

Additional Programming information.....45-46

LCP Display programming and options47-49

Fault / Error codes.....50-51

Section 9

Older Acu Drive programming (Smart Start) Flow.....53-57

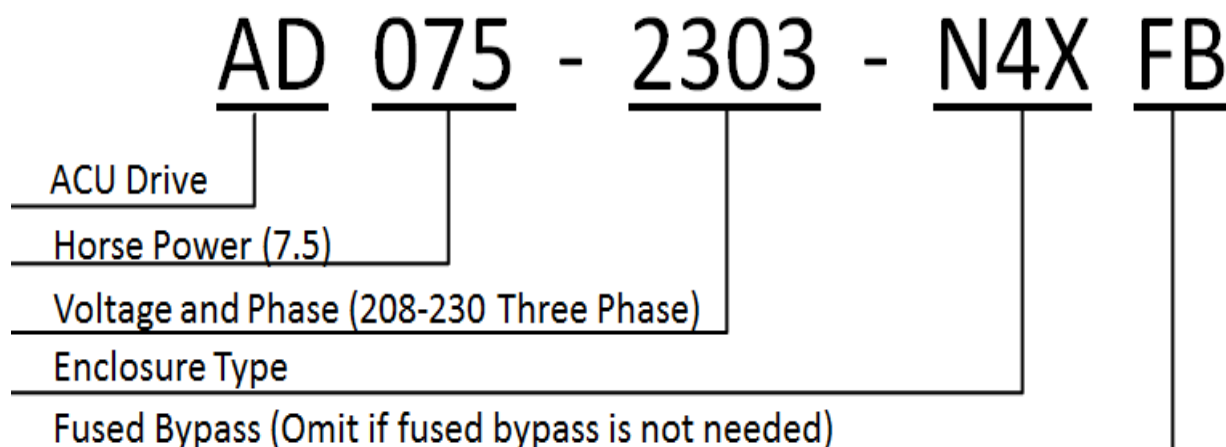
Older Acu Drive programming (Smart Start) Speed.....58-61

Older Acu Drive programming (Smart Start) Automation.....62-64

Acu Drive wire diagram.....65

Section 1: Drive Overview

1.1.0 - Part Number Breakdown and Accessories



				STANDARD DISCONNECT			FUSED BYPASS			
Voltage and Phase	HP	Amps	Frame	NEMA 1 Enclosure, Standard Disconnect (use -N01 suffix)	NEMA 12 Enclosure Standard Disconnect (use -N12 suffix)	NEMA 4X Enclosure Standard Disconnect (use -N4x suffix)	Nema 1 Enclosure, Fused Bypass (Use - N01FB suffix)	NEMA 12 Enclosure, Fused Bypass (Use - N12FB suffix)	NEMA 4X Enclosure Fused Bypass	
200-240 Single Phase Drive Input	200-240 Volts 1 phase			All single-phase drives come standart with a disconnect. All drives come standard with Battery Back-Up, and on site start-up						
	HP	Amps	Frame				NOT AVAILABLE WITH SINGLE PHASE TO THREE PHASE DRIVES			
	2	7.5	B1	AD020-2301-N01	AD020-2301-N12	AD020-2301-N4X				
	3	10.6		AD030-2301-N01	AD030-2301-N12	AD030-2301-N4X				
	5	16.7		AD050-2301-N01	AD050-2301-N12	AD050-2301-N4X				
	7 1/2	24.2		AD075 2301 N01	AD075 2301 N12	AD075 2301 N4X				
	10	30.8	B2	AD100-2301-N01	AD100-2301-N12	AD100-2301-N4X				
	20	59.4	C1	AD200-2301-N01	AD200-2301-N12	AD200-2301-N4X				
	30	88	C2	AD300-2301-N01	AD300-2301-N12	AD300-2301-N4X				
200-240 THREE PHASE	200-240 Volt 3 Phase			All single-phase drives come standart with a disconnect. All drives come standard with Battery Back-Up, and on site startup						
	HP	Amps	Frame							
	1/2.	2.4	A5	AD005-2303-N01	AD005-2303-N12	AD005-2303-N4X	AD005-2303-N01FB	AD005-2303-N12FB	AD005-2303-N4XFB	
	3/4.	3.5		AD007-2303-N01	AD007-2303-N12	AD007-2303-N4X	AD007-2303-N01FB	AD007-2303-N12FB	AD007-2303-N4XFB	
	1	4.6		AD010-2303-N01	AD010-2303-N12	AD010-2303-N4X	AD010-2303-N01FB	AD010-2303-N12FB	AD010-2303-N4XFB	
	1.5	6.6		AD015-2303-N01	AD015-2303-N12	AD015-2303-N4X	AD015-2303-N01FB	AD015-2303-N12FB	AD015-2303-N4XFB	
	2	7.5		AD020-2303-N01	AD020-2303-N12	AD020-2303-N4X	AD020-2303-N01FB	AD020-2303-N12FB	AD020-2303-N4XFB	
	3	10.6		AD030-2303-N01	AD030-2303-N12	AD030-2303-N4X	AD030-2303-N01FB	AD030-2303-N12FB	AD030-2303-N4XFB	
	5	16.7		AD050-2303-N01	AD050-2303-N12	AD050-2303-N4X	AD030-2303-N01FB	AD050-2303-N12FB	AD050-2303-N4XFB	
	7.5	24.2		AD075-2303-N01	AD075-2303-N12	AD075-2303-N4X	AD075-2303-N01FB	AD075-2303-N12FB	AD075-2303-N4XFB	
	10	30.8	B1	AD100-2303-N01	AD100-2303-N12	AD100-2303-N4X	AD100-2303-N01FB	AD100-2303-N12FB	AD100-2303-N4XFB	
	15	46.2		AD150-2303-N01	AD150-2303-N12	AD150-2303-N4X	AD150-2303-N01FB	AD150-2303-N12FB	AD150-2303-N4XFB	
	20	59.4		B2	AD200-2303-N01	AD200-2303-N12	AD200-2303-N4X	AD200-2303-N01FB	AD200-2303-N12FB	AD200-2303-N4XFB
	25	74.8		AD250-2303-N01	AD250-2303-N12	AD250-2303-N4X	AD250-2303-N01FB	AD250-2303-N12FB	AD250-2303-N4XFB	
	30	88	C1	AD300-2303-N01	AD300-2303-N12	AD300-2303-N4X	AD300-2303-N01FB	AD300-2303-N12FB	AD300-2303-N4XFB	
	40	115		AD400-2303-N01	AD400-2303-N12	AD400-2303-N4X	AD400-2303-N01FB	AD400-2303-N12FB	AD400-2303-N4XFB	
	50	143		AD500-2303-N01	AD500-2303-N12	AD500-2303-N4X	AD500-2303-N01FB	AD500-2303-N12FB	AD500-2303-N4XFB	
	60	179		AD600-2303-N01	AD600-2303-N12	AD600-2303-N4X	AD600-2303-N01FB	AD600-2303-N12FB	AD600-2303-N4XFB	

380-480 Volts 3 Phase				All Three-phase drives come standart with a disconnect. All drives come standard with Battery Back-Up, and on site startup					
380-480 Volts Three Phase	HP	Amps	Frame						
	1/2.	1.2	A5	AD005-4603-N01	AD005-4603-N12	AD005-4603-N4X	AD005-4603-N01FB	AD005-4603-N12FB	AD005-4603-N4XFB
	3/4.	1.6		AD007-4603-N01	AD007-4603-N12	AD007-4603-N4X	AD007-4603-N01FB	AD007-4603-N12FB	AD007-4603-N4XFB
	1	2.1		AD010-4603-N01	AD010-4603-N12	AD010-4603-N4X	AD010-4603-N01FB	AD010-4603-N12FB	AD010-4603-N4XFB
	1.5	2.7		AD015-4603-N01	AD015-4603-N12	AD015-4603-N4X	AD015-4603-N01FB	AD015-4603-N12FB	AD015-4603-N4XFB
	2	3.4		AD020-4603-N01	AD020-4603-N12	AD020-4603-N4X	AD020-4603-N01FB	AD020-4603-N12FB	AD020-4603-N4XFB
	3	4.8		AD030-4603-N01	AD030-4603-N12	AD030-4603-N4X	AD030-4603-N01FB	AD030-4603-N12FB	AD030-4603-N4XFB
	5	8.2		AD050-4603-N01	AD050-4603-N12	AD050-4603-N4X	AD050-4603-N01FB	AD050-4603-N12FB	AD050-4603-N4XFB
	7.5	11		AD075-4603-N01	AD075-4603-N12	AD075-4603-N4X	AD075-4603-N01FB	AD075-4603-N12FB	AD075-4603-N4XFB
	10	14.5		AD100-4603-N01	AD100-4603-N12	AD100-4603-N4X	AD100-4603-N01FB	AD100-4603-N12FB	AD100-4603-N4XFB
	15	21	B1	AD150-4603-N01	AD150-4603-N12	AD150-4603-N4X	AD150-4603-N01FB	AD150-4603-N12FB	AD150-4603-N4XFB
	20	27		AD200-4603-N01	AD200-4603-N12	AD200-4603-N4X	AD200-4603-N01FB	AD200-4603-N12FB	AD200-4603-N4XFB
	25	34		AD250-4603-N01	AD250-4603-N12	AD250-4603-N4X	AD250-4603-N01FB	AD250-4603-N12FB	AD250-4603-N4XFB
	30	40	B2	AD300-4603-N01	AD300-4603-N12	AD300-4603-N4X	AD300-4603-N01FB	AD300-4603-N12FB	AD300-4603-N4XFB
	40	52		AD400-4603-N01	AD400-4603-N12	AD400-4603-N4X	AD400-4603-N01FB	AD400-4603-N12FB	AD400-4603-N4XFB
	50	65	C1	AD500-4603-N01	AD500-4603-N12	AD500-4603-N4X	AD500-4603-N01FB	AD500-4603-N12FB	AD500-4603-N4XFB
	60	80		AD600-4603-N01	AD600-4603-N12	AD600-4603-N4X	AD600-4603-N01FB	AD600-4603-N12FB	AD600-4603-N4XFB
	75	105		AD750-4603-N01	AD750-4603-N12	AD750-4603-N4X	AD750-4603-N01FB	AD750-4603-N12FB	AD750-4603-N4XFB
	100	130	C2	ADC10-4603-N01	ADC10-4603-N12	ADC10-4603-N4X	ADC10-4603-N01FB	ADC10-4603-N12FB	ADC10-4603-N4XFB
	125	160		ADC13-4603-N01	ADC13-4603-N12	ADC13-4603-N4X	ADC13-4603-N01FB	ADC13-4603-N12FB	ADC13-4603-N4XFB
	150	190		ADC15-4603-N01	ADC15-4603-N12	ADC15-4603-N4X	ADC15-4603-N01FB	ADC15-4603-N12FB	ADC15-4603-N4XFB
	200	240	D1	ADC20-4603-N01	ADC20-4603-N12	ADC20-4603-N4X	ADC20-4603-N01FB	ADC20-4603-N12FB	ADC20-4603-N4XFB

				STANDARD DISCONNECT			FUSED BYPASS		
Voltage and Phase	HP	Amps	Frame	NEMA 1 Enclosure, Standard Disconnect (use -N01 suffix)	NEMA 12 Enclosure Standard Disconnect (use -N12 suffix)	NEMA 4X Enclosure Standard Disconnect (use -N4x suffix)	Nema 1 Enclosure, Fused Bypass (Use - N01FB suffix)	NEMA 12 Enclosure, Fused Bypass (Use - N12FB suffix)	NEMA 4X Enclosure Fused Bypass
	525-600 Volts 3 Phase			All Three-phase drives come standart with a Fused disconnect. All drives come Standard with Battery Back-Up, and on site startup					
525-600 Volts Three Phase	HP	Amps	Frame						
	1	1.7	A5	AD010-5753-N01	AD010-5753-N12	AD010-5753-N4X	AD010-5753-N01FB	AD010-5753-N12FB	AD010-5753-N4XFB
	1.5	2.4		AD015-5753-N01	AD015-5753-N12	AD015-5753-N4X	AD015-5753-N01FB	AD015-5753-N12FB	AD015-5753-N4XFB
	2	2.7		AD020-5753-N01	AD020-5753-N12	AD020-5753-N4X	AD020-5753-N01FB	AD020-5753-N12FB	AD020-5753-N4XFB
	3	3.9		AD030-5753-N01	AD030-5753-N12	AD030-5753-N4X	AD030-5753-N01FB	AD030-5753-N12FB	AD030-5753-N4XFB
	5	6.1		AD050-5753-N01	AD050-5753-N12	AD050-5753-N4X	AD050-5753-N01FB	AD050-5753-N12FB	AD050-5753-N4XFB
	7.5	9		AD075-5753-N01	AD075-5753-N12	AD075-5753-N4X	AD075-5753-N01FB	AD075-5753-N12FB	AD075-5753-N4XFB
	10	11		AD100-5753-N01	AD100-5753-N12	AD100-5753-N4X	AD100-5753-N01FB	AD100-5753-N12FB	AD100-5753-N4XFB
	15	18	B1	AD150-5753-N01	AD150-5753-N12	AD150-5753-N4X	AD150-5753-N01FB	AD150-5753-N12FB	AD150-5753-N4XFB
	20	22		AD200-5753-N01	AD200-5753-N12	AD200-5753-N4X	AD200-5753-N01FB	AD200-5753-N12FB	AD200-5753-N4XFB
	25	27		AD250-5753-N01	AD250-5753-N12	AD250-5753-N4X	AD250-5753-N01FB	AD250-5753-N12FB	AD250-5753-N4XFB
	30	34	B2	AD300-5753-N01	AD300-5753-N12	AD300-5753-N4X	AD300-5753-N01FB	AD300-5753-N12FB	AD300-5753-N4XFB
	40	41		AD400-5753-N01	AD400-5753-N12	AD400-5753-N4X	AD400-5753-N01FB	AD400-5753-N12FB	AD400-5753-N4XFB
	50	52		AD500-5753-N01	AD500-5753-N12	AD500-5753-N4X	AD500-5753-N01FB	AD500-5753-N12FB	AD500-5753-N4XFB
	60	62	C1	AD600-5753-N01	AD600-5753-N12	AD600-5753-N4X	AD600-5753-N01FB	AD600-5753-N12FB	AD600-5753-N4XFB
	75	83		AD750-5753-N01	AD750-5753-N12	AD750-5753-N4X	AD750-5753-N01FB	AD750-5753-N12FB	AD750-5753-N4XFB
	100	100	C2	ADC10-5753-N01	ADC10-5753-N12	ADC10-5753-N4X	ADC10-5753-N01FB	ADC10-5753-N12FB	ADC10-5753-N4XFB
	125	131		ADC13-5753-N01	ADC13-5753-N12	ADC13-5753-N4X	ADC13-5753-N01FB	ADC13-5753-N12FB	ADC13-5753-N4XFB

1.2.0 - Enclosure Options

NEMA TYPE 1.

General Purpose - Type 1 enclosures are intended for use indoors, primarily to prevent accidental contact of personnel with the enclosed equipment, in areas where unusual service conditions do not exist. In addition, they provide protection against falling dirt.

NEMA TYPE 12.

Dust and Drip tight-Indoor - Type 12 enclosures are intended for use indoors to protect the enclosed equipment against fibers, flying, lint, dust and dirt, and light splashing, seepage, dripping and external condensation of non-corrosive liquids. There shall be no holes through the enclosure and no conduit knockouts or conduit openings, except that oil tight or dust tight mechanisms may be mounted through holes in the enclosure when provided with oil-resistant gaskets. NEMA 12 enclosures may be used outdoors when drive is protected from direct rain and harsh sun.

NEMA TYPE 4X

The IP66 enclosure offers full protection from dust, moisture and dirt. The IP66 enclosure has a special epoxy coating which makes it resistant to corrosive environments found within a pump room, and outside weather conditions. The enclosure of the IP66 drives is fastened with stainless steel screws that are also corrosion resistant. This IP66 is the most protective enclosure offered in the drive market, and recommended for unprotected outdoor installations, and harsh indoor pump room conditions.



**ACU DRIVE FLOW SENSOR KITS
WITH INTEGRAL 4-20ma OUTPUT SIGNAL
INCLUDES PVC CLAMP-ON SADDLE**
(Does not include separate wall mount flow display)

Product	Description	
97014-4203kit	3 in, Flow sensor kit with 4-20 output	
97014-4204kit	4 in, Flow sensor kit with 4-20 output	
97016-4206kit	6 in, Flow sensor kit with 4-20 output	
97016-4208kit	8 in, Flow sensor kit with 4-20 output	

Flow Sensor Kits With Separate Wall Mount Display and
Transmitter: includes saddle (PVC clamp-on style)

**ACU DRIVE FLOW SENSOR KITS
WITH INTEGRAL 4-20 ma SIGNAL
INCLUDES PVC CLAMP-ON SADDLE
AND WALL MOUNTED DISPLAY**

Product	Description
97014BL-03kit	3 in, Flow sensor kit with 4-20 output and wall mount display/PVC Saddle
97014BL-04kit	4 in, Flow sensor kit with 4-20 output and wall mount display/PVC Saddle
97016BL-06kit	6 in, Flow sensor kit with 4-20 output and wall mount display/PVC Saddle
97016BL-08kit	8 in, Flow sensor kit with 4-20 output and wall mount display/PVC Saddle
97020BL-10kit	10 in, Flow sensor kit with 4-20 output and wall mount display/Iron Saddle
97020BL-12kit	12 in, Flow sensor kit with 4-20 output and wall mount display/Iron Saddle

Signet Magmeter

Item	Description
97014MM-4203KIT	KIT, 3" MAGMETER FLOW SENSR WITH INTEGRAL 4-20 OUTPUT
97014MM-4204KIT	KIT, 4" MAGMETER FLOW SENSR WITH INTEGRAL 4-20 OUTPUT
97016MM-4206KIT	KIT, 6" MAGMETER FLOW SENSR WITH INTEGRAL 4-20 OUTPUT
97016MM-4208KIT	KIT, 8" MAGMETER FLOW SENSR WITH INTEGRAL 4-20 OUTPUT

**OPTIONAL BACK PLATE FOR ACU DRIVES
THAT ARE NOT MOUNTED FLUSH TO A FLAT SURFACE**

Product	Frame	Description
AD-130B1098	A5	OPTIONAL BACK PLATRE A5 FRAME,GALVANIZED STEEL
AD-130B3383	B1	OPTIONAL BACK PLATRE B1 FRAME,GALVANIZED STEEL
AD-130B3397	B2	OPTIONAL BACK PLATRE B2 FRAME,GALVANIZED STEEL
AD-130B3910	C1	OPTIONAL BACK PLATRE C1 FRAME,GALVANIZED STEEL
AD-130B3911	C2	OPTIONAL BACK PLATRE C2 FRAME,GALVANIZED STEEL

Acu Drive XS Enhanced Service Warranty

The Enhanced Service and Warranty upgrades the standard manufacturer warranty by covering parts , labor and travel cost to the customer site.

In the event the covered Acu Drive XS drive fails during the Enhanced Service Warranty period, the drive will be repaired or replaced at the manufacturer's discretion, at the customer site.

Coverage applies to warranty contracts purchased prior to Acu Drive XS shipment and begins on the date of shipment and extends to the end of the contract period.

Please feel free to contact Pentair for other service and extended warranty options available for the Pentair Acu Drive XS.

Pentair Water Quality Systems
Lagrangeville, NY
845-463-7200

Enhanced Service and Warranty On-Site
Includes Parts, Labor, Travel and
Warranty Repair
Use Product Numbers As Follows

EXTENDED WARRANTY

	208-230 Volts		380-690 Volts	
Duration	3 Hp and Below	5-25 HP	10 HP and Below	15-40 HP
3 Year	AD-EWW136	AD-EWW236	AD-EWW136	AD-EWW236
6 Year	AD-EWW172	AD-EWW272	AD-EWW172	AD-EWW272

2.7.0 - Acu Drive Startup Request Information Sheet

Please complete the following information and return to Paragon Aquatics (phone - 845-463-7200, ext. 2 / fax - 845-463-7291 / email - paragoncustserv@pentair.com) in order to schedule the startup service for your new Acu-Drive. A startup service partner will contact the job site contact person listed below to schedule the startup.

**** Before Requesting a Start-Up be Performed, Please
Ensure the Following has been Completed ****

- ☐ All VFDs requiring start-up have been properly mounted per installation guide
- ☐ The power wiring has been properly connected to each VFD
- ☐ Any control wiring (i.e. flowmeter, level control, alarms) have been properly connected
- ☐ If needed, be prepared to explain any special programming requirements with startup representative

Startup Job Site Information:

Requested Startup Date:

Facility Name:

Street:

City:

State/Province:

Zip Code:

Number of units to startup:

Acu-Drive Serial #(s):

Site Contact Name:

Contact Phone Number:

By signing below, please confirm that your equipment will be ready for startup by the requested startup date listed below:

"I confirm that the equipment for startup will be ready for startup at a time and date agreed to by the contact person listed above and startup service partner. All control and power wiring necessary to perform startup will be completed by the agreed date. All processes will be ready and available by the agreed date. All equipment is installed per Danfoss installation instructions and all local codes. I will coordinate all personnel and contractors that I want present at startup. I agree to notify the startup service partner 24 hours prior to the agreed startup time and date of any changes to the schedule. I accept any additional charges not covered by the service agreement for the startup contract."

Print Name:

Phone:

Signature:

Date:

Start Up Required Information Sheet

This information will be used by the Pentair representative to perform the startup service required for your Acu Drive™ XS Variable Frequency Drive. Please fill out all information to the best of your knowledge. If there are any fields that you can not fill out please contact _____ to help you find this information. The numbers under each field are there for use by the startup representative, please do not base your answer off of that number.

What is the maximum flow rate your pump can deliver at full RPM after a backwash has been performed on the system? _____ GPM
(3-03)

What is the required flow rate during normal operation? _____ GPM
(3-10 [0])

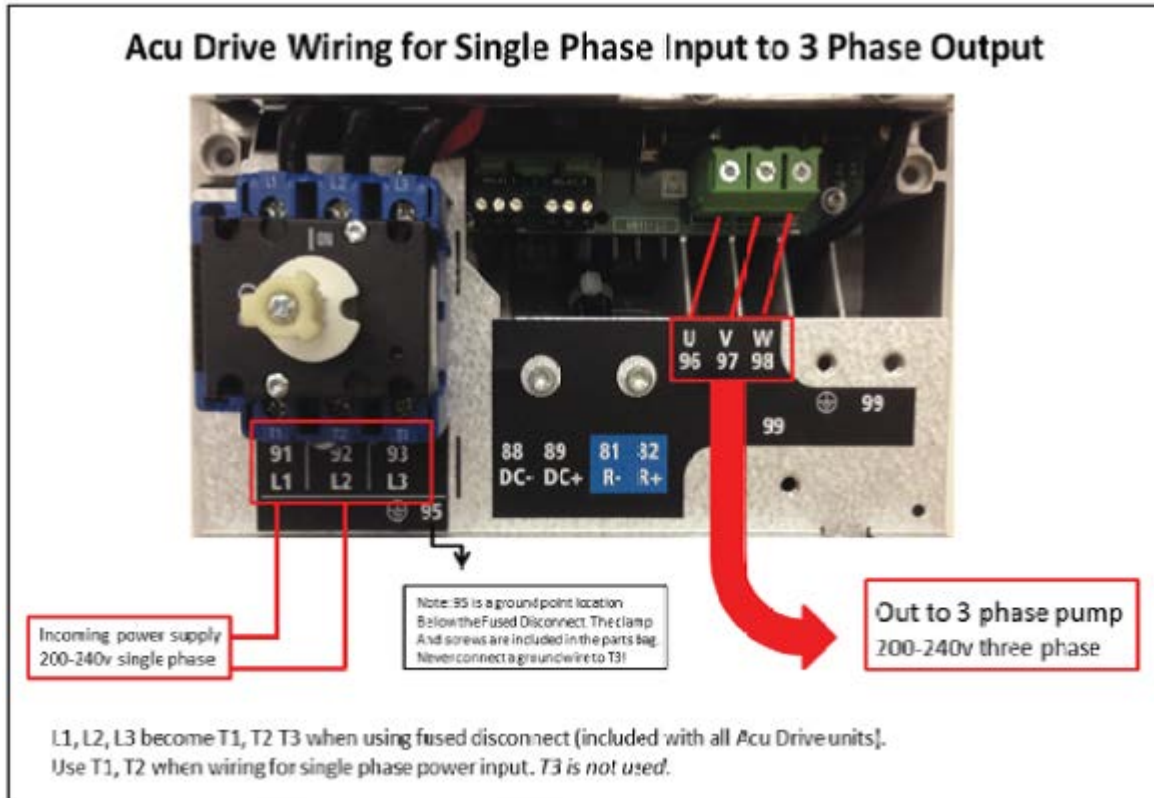
How many timed pump actions do you wish to have in one day? (1-4) _____

	Description Of Operation	Time On	Time Off	Flow Rate GPM
1	Normal Pool Operation Flowrate			
	(Timed Action 1)	(23-00)	(23-02)	(3-10 [0])
2	Non- Operating Hours “Night Time” Flowrate			
	(Timed Action 2)	(23-00)	(23-02)	(3-10 [1])
3	Optional			
	(Timed Action 3)	(23-00)	(23-02)	(3-10 [2])
4	Optional			
	(Timed Action 4)	(23-00)	(23-02)	(3-10 [3])

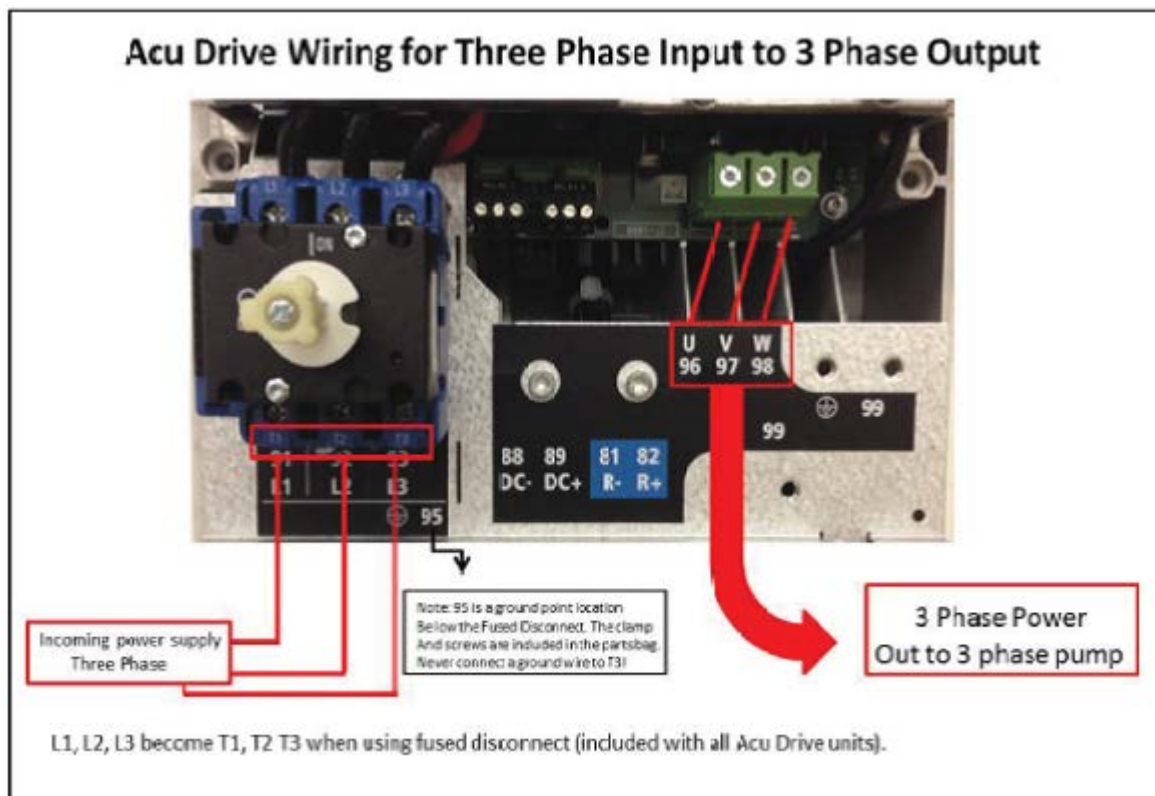
Required Motor Information:

Parameter Description	Parameter Units	Parameter Value
Motor Power	[HP]	
		(1-21)
Motor Voltage as Wired	[V]	
		(1-22)
Motor Frequency	[HZ]	
		(1-23)
Motor Current	[A]	
		(1-24)
Motor Nominal Speed	[RPM]	
		(1-25)

Acu Drive Wiring: Single Phase in Three Phase Out



Acu Drive Wiring: Three Phase In and Out



Section 2: Initial Setup and Startup

To Reset Drive to Factory Settings

Option 1:

1. Power down drive and wait for all lights to go off.
2. Press and hold: Status, Main Menu and OK.
3. Power up drive, continue holding all 3 buttons for five seconds then release.

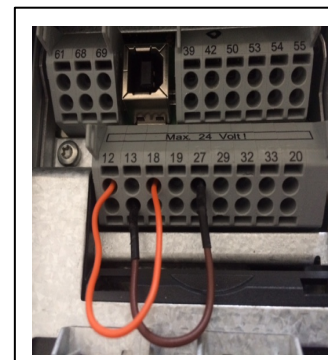
Option 2:

Go to parameter 14-22 and change to (2) initialization. Power drive off until lights go off then power up.



Initial Programming Procedure

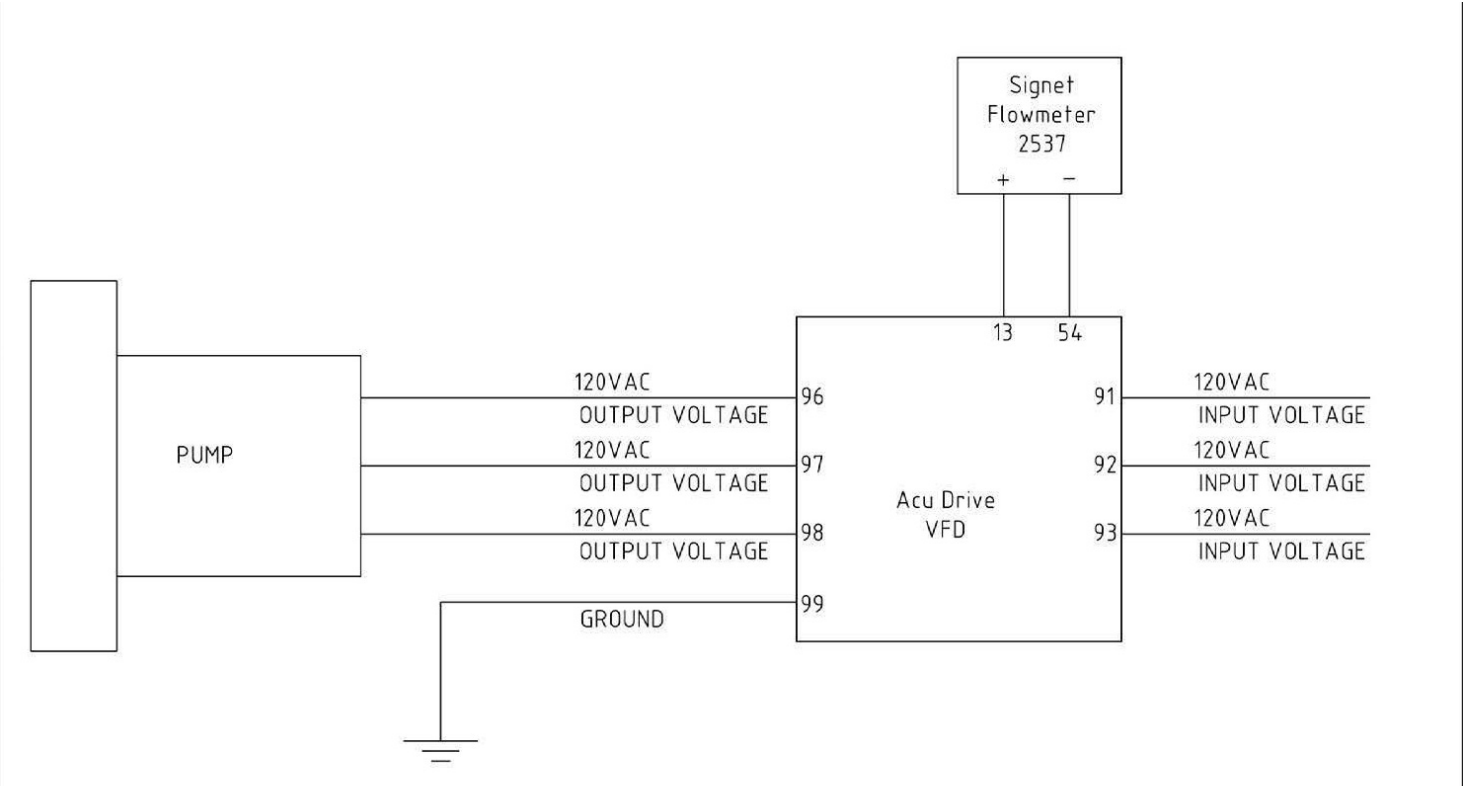
- See that there is a jumper inside the drive that links 12 and 18 together. This will act as a start command for the Acu Drive™ XS Variable Frequency Drive.
- Press the Main Menu key twice
- Select Group 0 [Operation/Display] by highlighting parameter, then Pressing OK. The up and Down Arrows will move the cursor
- Select 0-0 [Basic Settings], Press OK
- Press Down Arrow until you are at Parameter 0-03 [Regional Settings]
- Press the Down Arrow until you see [1] North America. Press OK.
- VFD may be in alarm when first initiated.
- Press the Main Menu key
- Press the Down Arrow to 5- Digital In/Out, Press OK
- Arrow down to 5-1 [digital inputs]
- Arrow down to 5-12 [Terminal 27 digital input]
- Make sure that [0] No Operation is chosen or you can install jumper between terminal 13 and 27 as shown



Changing Motor Speed Units (Optional)

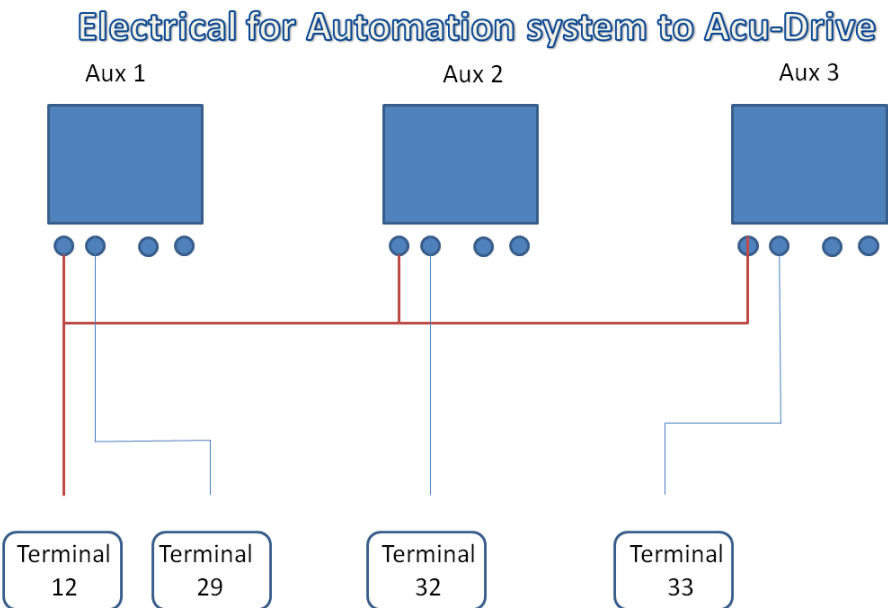
- Press the Main Menu key twice.
- Select Group 0 [Operation/Display] by highlighting parameter, then Pressing OK.
- Select 0-0 [Basic Settings], Press OK.
- Press the Down Arrow until you are at Parameter 0-02 [Motor Speed Unit].
- Change units between RPM and Hz, Press OK.
- Press OK

8.2.0 - Acu Drive™ XS Variable Frequency Drive with Flowmeter



4.2.4 - Wire Diagram for Automation System Relays

- Refer to below table for wiring and activating appropriate input for desired preset reference speed selection on the Acu Drive™ XS Variable Frequency Drive.



Section 3: Programming the Drive to Follow Flowmeter Input



3.0.1 - Configuring the Drive to Accept the Analog Input Signal

- Confirm that the flowmeter 4-20mA output is connected to Analog 54 input (Signal coming in from the 4-20mA transmitter)
- Remove the keypad from the Acu Drive™ XS Variable Frequency Drive
- Locate the A54 switch (may be under battery back-up module)
- Move the switch to the right, or where the I is located (I is for current, or 4-20mA signal)
- Reinstall keypad
- Connect flow meter wires to terminals 12 and 54 Red to 12 and black to 54 (flow meter wires are polarity sensitive)

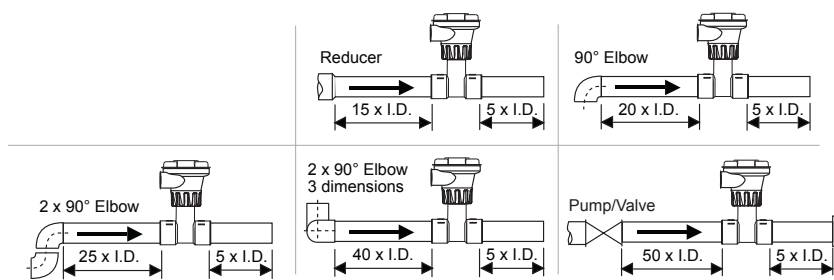


Flowmeter Installation

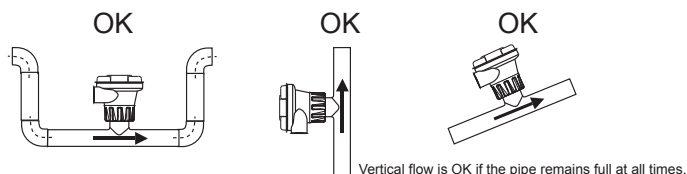
Installation Location Requirements

Recommended sensor upstream/downstream mounting requirements:

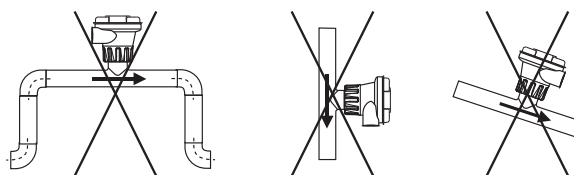
Select a location with sufficient length of straight pipe immediately upstream of the sensor.



Locating the sensor in a trap or where the flow is upward helps to protect the sensor from exposure to air bubbles when the system is in operation.

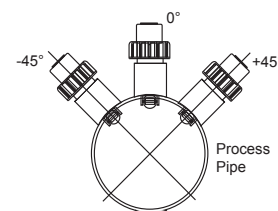


These configurations are not recommended because it is difficult to keep the pipe full.



Sensor Mounting Position

- Horizontal pipe runs: Mount sensor in the upright (0°) position for best performance. Mount at a maximum of 45° when air bubbles are present (pipe must be full). Do not mount on the bottom of the pipe when sediments are present.
- Vertical pipe runs: Mount sensor in any orientation; however, downward flow is not recommended. Upward flow is preferred to ensure full pipe.



Pipe Fittings

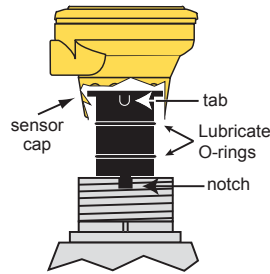
Georg Fischer Signet offers a wide selection of installation fittings that control the position of the paddlewheel in relation to the dimensions of the pipe.

Type	Description
Plastic tees 	0.5 to 2 inch versions (MPVC or CPVC) 2.5 to 4 inch versions (PVC)
PVC Glue-on Saddles 	- Available in 10 and 12 inch sizes only - Cut 2-1/2 inch hole in pipe - Weld in place using solvent cement
PVC Saddles 	2 to 4 inch, cut 1-7/16 inch hole in pipe 6 to 8 inch, cut 2-1/8 inch hole in pipe
Iron Strap-on saddles 	2 to 4 inch, cut 1-7/16 inch hole in pipe - Over 4 inch, cut 2-1/8 inch hole in pipe - Special order 14 in. to 36 in.
Metric Wafer Fitting 	- For pipes DN65 to 200 mm - PP or PVDF

Type	Description
Iron, Carbon Steel, 316 SS Threaded tees 	0.5 to 2 in. versions - Mounts on threaded pipe ends
Carbon steel & stainless steel Weld-on Weldolets 	2 to 4 inch, cut 1-7/16 inch hole in pipe - Over 4 inch, cut 2-1/8 inch hole in pipe
Fiberglass tees FPT 	1.5 in. to 2 in. PVDF insert
Metric Union Fitting 	- For pipes from DN 15 to 50 mm - PP or PVDF

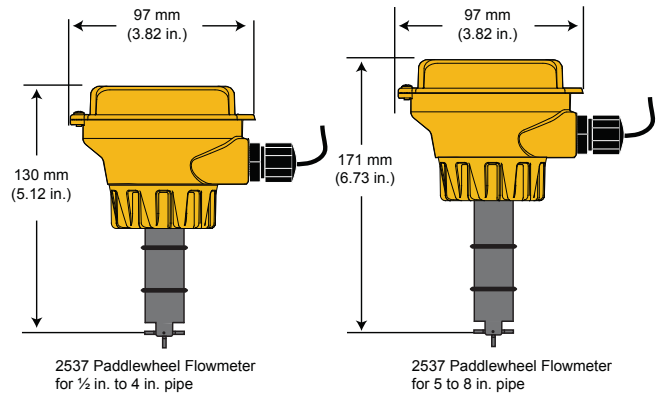
Plastic Sensor Installation Tips

- Inspect the sensor O-rings for nicks and other damage that may compromise the seal.
- Lubricate O-rings with a non-petroleum based, viscous lubricant (grease) compatible with the system.
- Using an alternating/twisting motion, lower the sensor into the fitting, making sure the conduit ports on the yellow housing are pointing in the direction of flow.
- Engage one thread of the sensor cap then turn the sensor until the alignment tab is seated in the fitting notch.



HAND-TIGHTEN THE THREADED NUT ONTO THE INSTALLATION FITTING. DO NOT USE TOOLS! DO NOT USE THREAD SEALANT OR LUBRICANTS ON THE FITTING THREADS OR THE SENSOR CAP.

Dimensions

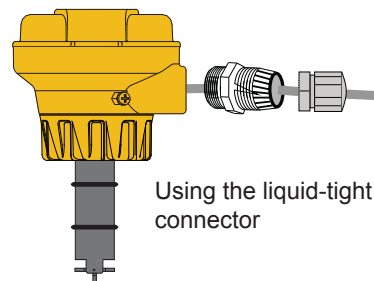
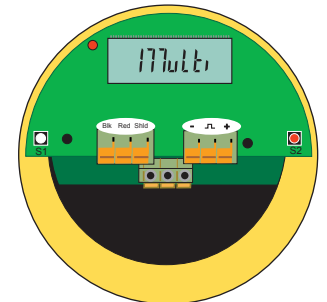
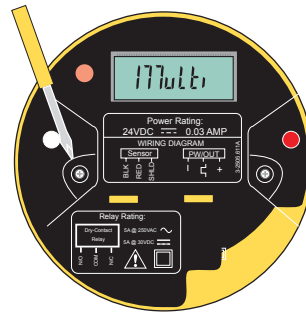
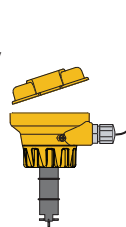


Flowmeter Wiring

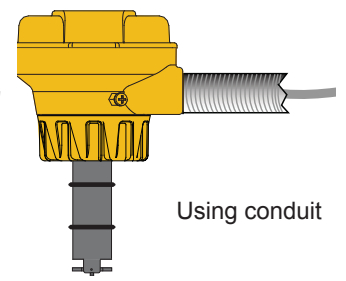
Electrical connections to this product should be made only by qualified personnel.

To access the wiring terminals:

- Turn yellow cap 1/4 turn counterclockwise to remove.
- Remove the two retaining screws and remove the black cover.
- Route all cables through the conduit ports before connecting them to the terminals.
- Wiring terminals are rated for 16 to 22 AWG conductors.
- The cable must be 7 to 10 mm in diameter (0.275 to 0.394 in.) to seal properly in the liquid tight connector.
- The conduit ports have 1/2 inch NPT threads. After routing the cables, seal the port with a liquid tight conduit connector (3-9000.392-1) or with conduit.
- For conduit installations:
 - Thread conduit with 1/2 in. NPT threads directly into the conduit port.
 - For conduit with ISO threads, use the black thread adapter included with the connector kit.
 - To comply with NEC requirements, do not use any metal conduit in the installation.



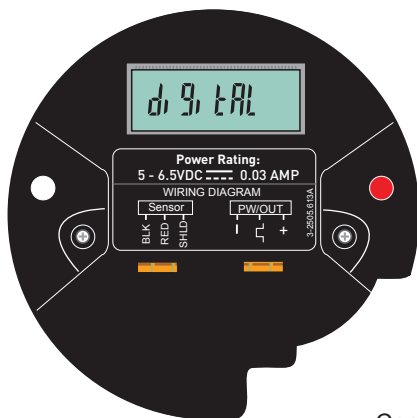
Using the liquid-tight connector



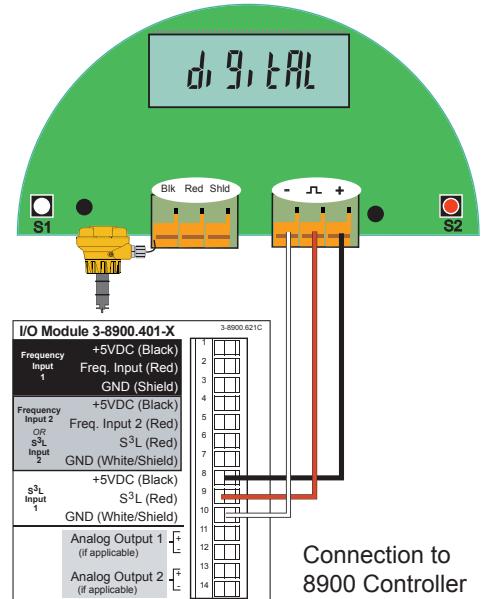
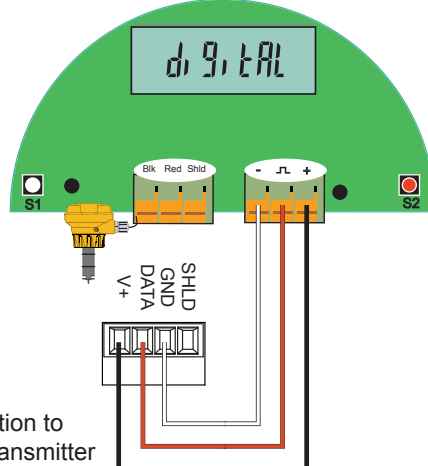
Using conduit

Wiring: Digital (S³L) Output

The Digital (S³L) output is compatible with the 3-8900 Multi-Parameter Controller and the 3-9900 Transmitter.



Connection to 9900 Transmitter

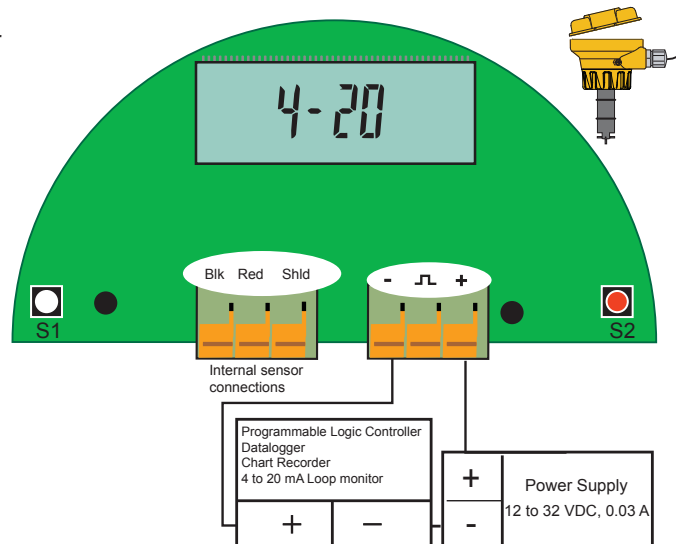
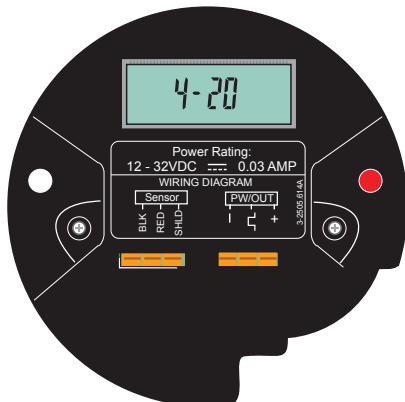


Connection to 8900 Controller

Wiring: 4 to 20 mA Output

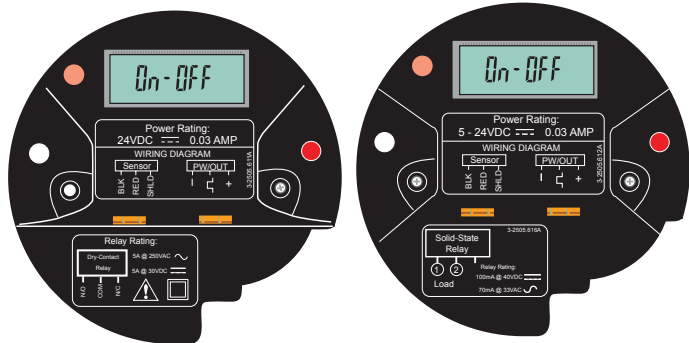
The 4 to 20 mA output can be connected to Chart Recorders, PLCs or any device that requires a 4 to 20 mA signal.

The 4 to 20 mA model requires an external power source of 12 to 32 VDC.



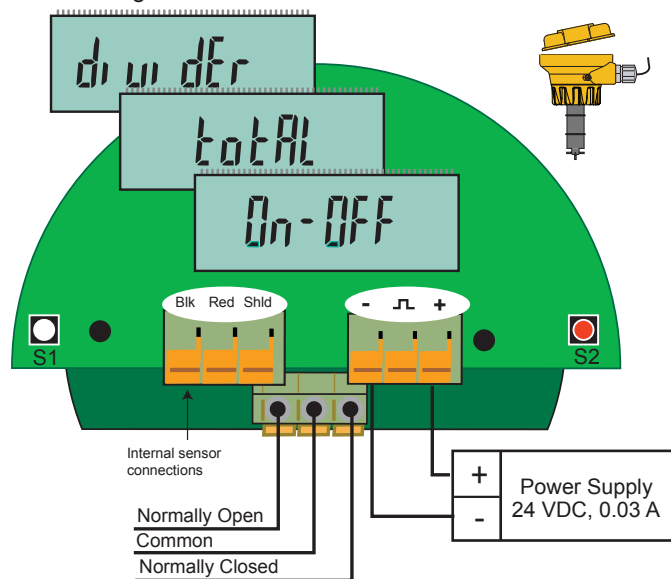
Wiring: Flow Switch Output (On-OFF)

- The Flow Switch mode allows a single relay that is programmable as a HIGH setpoint or LOW setpoint.
- The relay may be a dry-contact type or a solid state type.
- The dry contact relay requires an external power source of 24 VDC $\pm$ 10%.
- The solid state relay requires an external power source of 5 to 24 VDC.



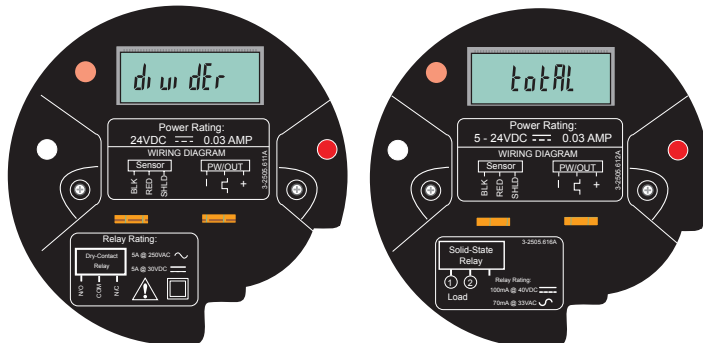
Dry Contact Relay Wiring

- The wiring is identical for On-OFF and Pulse modes.



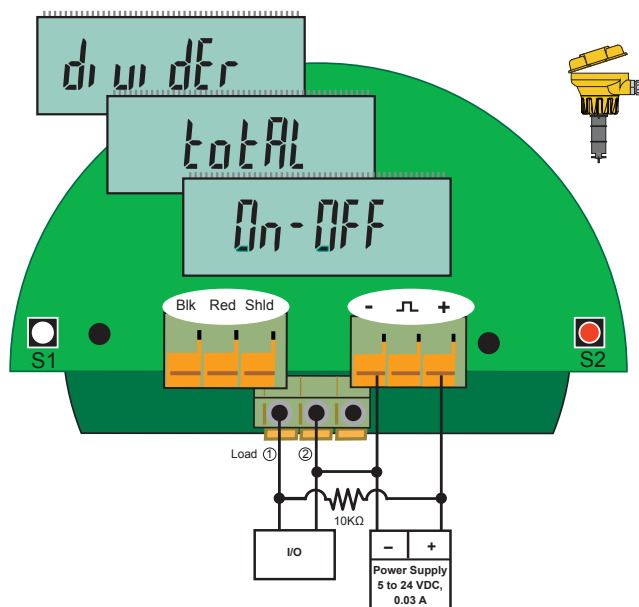
Wiring: Pulse Output

- The "Multi" mode allows a single relay that is programmable as a Flow Switch, Volumetric pulse output or as a simple pulse divider output.
- The relay may be a dry-contact type or a solid state type.
- The Dry Contact Relay requires an external power source of 24 VDC $\pm$ 10%.
- The Solid State Relay requires an external power source of 5 to 24 VDC.
- Solid State Relay requires a pull-up resistor (10K ohm recommended). Consult your instrument/PLC manual for wiring information.



Solid State Relay Wiring

- The wiring is identical for On-OFF and Pulse modes.



Menu Details

This table shows the definition of each menu function, the setting parameters and the page where detailed instructions can be located.

Menu Function	Definition	Setting Parameters
Flow Unit	Liters or Gallons per sec, min., hour or day	
K-Factor	Set PULSES per VOLUME UNIT	0.0001 to 999999
Average	Smooths out erratic flow conditions	0 to 100 seconds
Sensitivity	Overrides Average for large rate changes	0 to 9
4 Set	Set flow RATE to be represented by 4 mA	0.0000 to 99999
20 Set	Set flow RATE to be represented by 20 mA	0.0000 to 99999

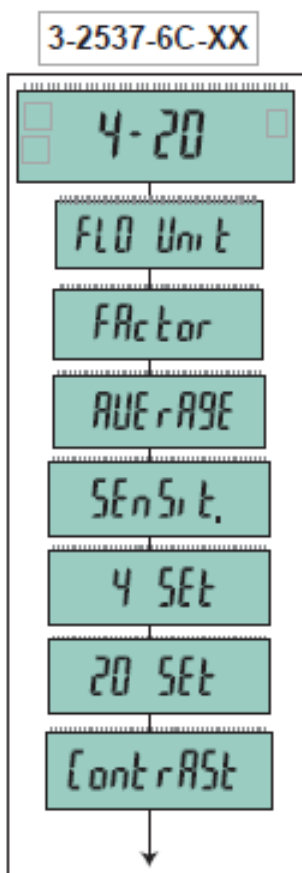
Operation

The 2537 Flowmeter is available in three different models. The programming menus vary significantly from one model to another.

This chart is provided inside the yellow cover to assist in navigating the menus in the 2537.

Mode	Action		
View	→ Display Flow Rate	→ Go to MENU	Go to VIEW
Menu	1X → Next Menu	1X → Display Current Value	Previous Mode
		→ Go to Edit	Previous Mode
		1X → Shift digit to right	Previous Mode
Edit	1X → Increment Value	→ Go to SAVE	Previous Mode
SAVE	1X → Toggle	1X → Store Change	N/A

Menus



4-20 ma flow meter

Select GPM

K Factor (use proper k factor for type of pipe and saddle being used)

Sample rate ranges from 0-100 seconds (start at 50 seconds)

How much change occurs from 0 to 9 (Start at 4) (the higher the number the more dramatic the change)

Lowest GPM pump output (set to 0) (must match drive setting)

Highest GPM the pump is capable of

Display Contrast adjustment

- All models display the model name: **Multi**, **Digital** or **4-20**.
- If the white key (S1) is held down for three seconds, the flow rate is displayed for 10 minutes before reverting back to the model name.
 - In the **Multi** Model, if the "Multi" menu item is set to "divider", then the divided pulse output will be displayed in pulses/seconds (p/s).

Flow Units

This function is available on these versions of the 2537.

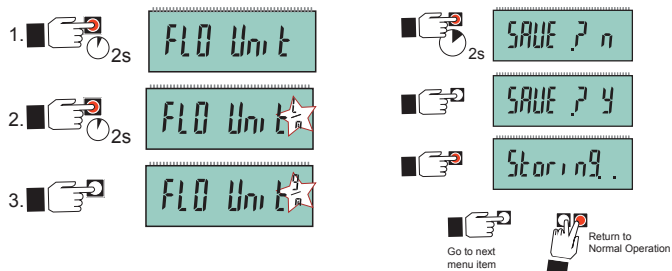
177uLt, d, g, tAL
4-20

Select the volumetric units for the flow measurement.

$\frac{L}{s}$ Liters/second	$\frac{g}{s}$ Gallons/second
$\frac{L}{m}$ Liters/minute (Factory setting)	$\frac{g}{m}$ Gallons/minute
$\frac{L}{h}$ Liters/hour	$\frac{g}{h}$ Gallons/hour
$\frac{L}{d}$ Liters/day	$\frac{g}{d}$ Gallons/day

Example: Set the Flow Units to Gallons per minute:

Save the new setting:



K-Factor

A K-Factor is the number of pulses a sensor will generate for each engineering unit of fluid that passes the sensor. The factory setting is 60.0000. Locate the K-Factor in the tables on page 37 and 38.

This function is available on the above versions of the 2537.

177uLt, d, g, tAL
4-20

Factor

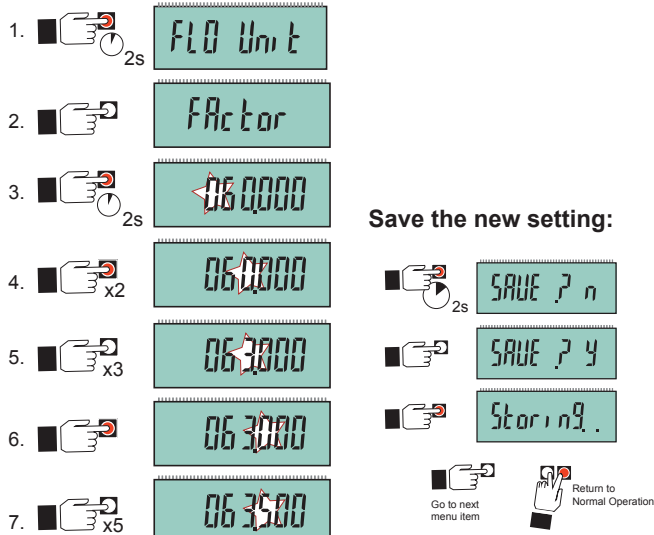
Minimum value

0.0001

Maximum value

999999

Example: Set the K-Factor to 63.5 Pulses per Gallon:



Set 4 and Set 20

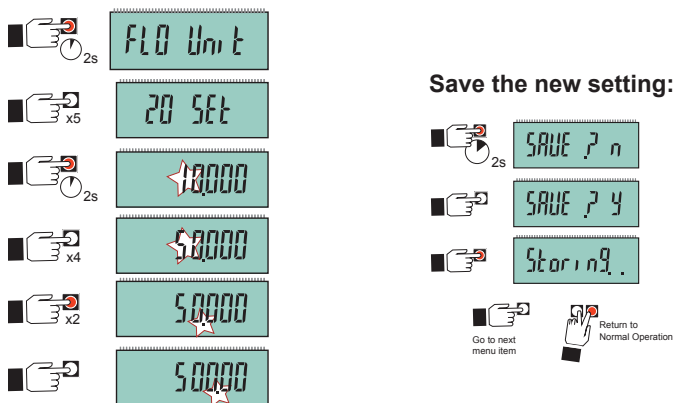
4-20

This function is available on these versions of the 2537.

These two functions are used to span the 4 to 20 mA output signal to the required range. The factory setting is 4 to 20 mA = 0 to 10.000

Only the 20 mA span is illustrated here.

Example: Set 20 mA = 500 GPM.



Set Contrast

This function is available on these versions of the 2537.

177uLt, d, g, tAL
4-20

All models of the 2537 have the CONTRAST adjustment. It is always located at the end of the menu.

- Press the arrow key to enter the menu and scroll until the Contrast display appears.
- Press the right arrow key to enter the value 1.

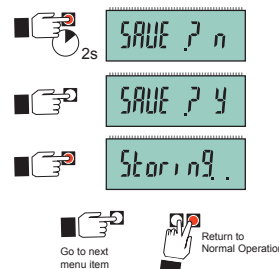
Repeat until :

Three levels of adjustment are available. The factory setting of 3 is the highest contrast setting.

Choose:

1 OR 2 OR 3

Save the new setting:



- Averaging and Sensitivity Settings

- Because ideal γ ow conditions are often impossible to achieve, the γ ow rate is often erratic, which causes erratic readings in control features (e.g., relays, 4 to 20 mA loops, etc.) that are associated with the flow rate.
- The best solution to these problems is to correct any piping deficiency that causes the instability. This may involve longer straight runs upstream, reducing the pipe size to maintain a full pipe at all times, and other installation changes. In many situations, however, these measures are simply not possible.
- The 2537 meter provides two tools that are designed to "work around" these deficiencies. The Averaging and the Sensitivity features should be studied before making adjustments.

Averaging Time in Seconds (Factory set: 0 seconds)

- Set the time the meter will use as the averaging period. The range is from 0 (no average applied to input) to 100 (seconds of averaging applied to input).

Use higher averaging times to smooth the display and current output where the γ ow in the pipe is erratic.

Quick Response Sensitivity (Factory set: 0)

- Set the relative degree of change in the γ ow rate required to allow the 2537 to disable the AVERAGING and jump to a new γ ow rate immediately. The scale is from 0 (least sensitive, averaging is never disabled.) to 9 (a very small change in γ ow rate will disable the averaging).

■■■■■ No AVERAGING, no SENSITIVITY

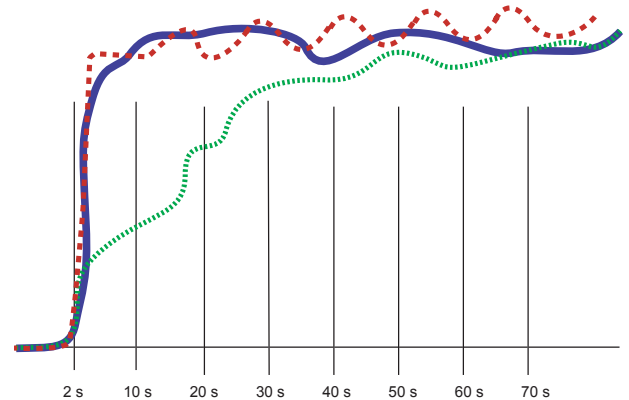
With AVERAGING set to 0 (zero) and with SENSITIVITY set to zero, the 2537 responds to every unstable shift in the γ ow. The dashed red line represents the actual output of the γ ow sensor in unstable γ ow conditions.

..... AVERAGING only

With AVERAGING set to 50 seconds and SENSITIVITY still set to zero the γ ow rate is stabilized, but a sharp change in γ ow rate is not represented for 50 seconds or longer (dotted green line).

———— AVERAGING and SENSITIVITY

With AVERAGING at 50 seconds and SENSITIVITY set to 4 OR 5, the γ ow rate is stabilized, while the sudden shift in γ ow is reflected very quickly (solid blue line).



NOTE: The SENSITIVITY function is ineffective if the AVERAGING function is set to zero (seconds).

Set Averaging

This function is available on these versions of the 2537:

di 9, t RL

4-20

AVERAGE

The factory setting is 0 (zero).

Minimum value

000s

Maximum value

100s

Example:

Set the Averaging for 50 seconds.

Save the new setting:

1. 2s
2. x2
3. 2s
- 4.
5. x5

Go to next menu item Return to Normal Operation

Set Sensitivity

This function is available on these versions of the 2537:

di 9, t RL

On-OFF

4-20

SENSIT.

The factory setting is 0 (zero).

Minimum value

0

Maximum value

9

Example: Set the Sensitivity to 5.

Save the new setting:

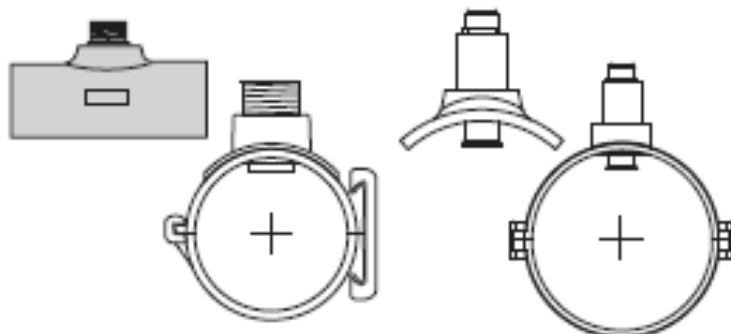
1. 2s
2. x3
3. 2s
4. x5

Go to next menu item Return to Normal Operation

K-Factors

When using the PULSE DIVIDER mode, associated equipment must divide the K-Factors by the P-Factor.

A **K-Factor** is the number of pulses a sensor will generate for each engineering unit of fluid that passes the sensor. K-Factors for water are listed below in U.S. gallons and liters. For example, in a 1 inch SCH 80 PVC pipe, using the MPV8T010 PVC fitting, the 2537 paddlewheel generates 335.53 pulses per gallon of water passing the rotor.



Saddles

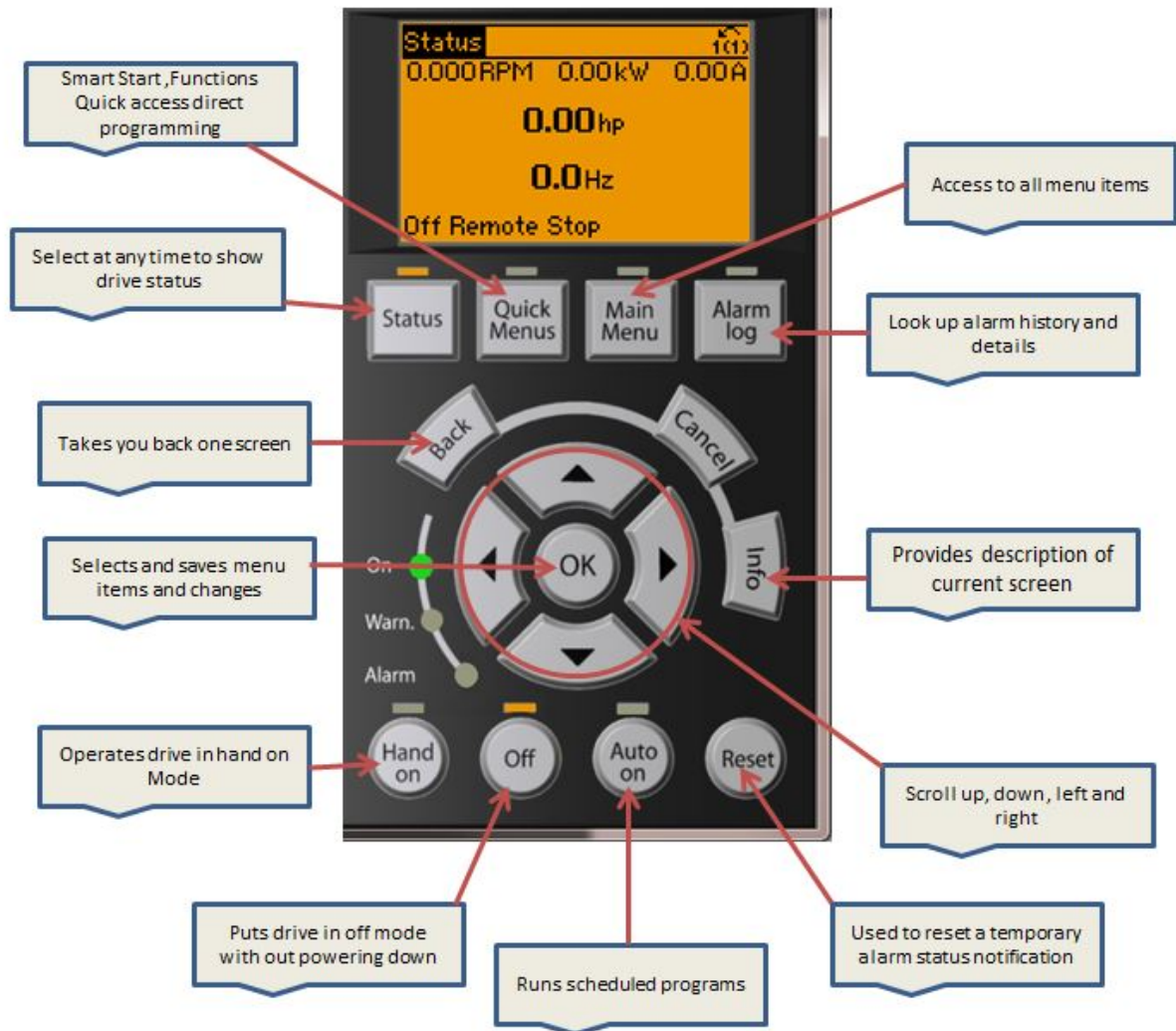
PIPE SIZE (IN.)	FITTING	2537 SENSOR	
		U.S. GAL	LITERS
SCH 80 PVC SADDLES FOR SCH 80 PVC PIPE			
2	PV8S020	66.739	17.633
2-1/2	PV8S025	42.994	11.359
3	PV8S030	26.652	7.0414
4	PV8S040	15.006	3.9645
6	PV8S060	8.3246	2.1994
8	PV8S080	5.0164	1.3253
SCH 80 PVC SADDLE ON SCH 40 PVC PIPE			
2	PV8S020	54.700	14.452
2-1/2	PV8S025	37.159	9.8175
3	PV8S030	23.697	6.2608
4	PV8S040	13.456	3.5552
6	PV8S060	7.4594	1.9708
8	PV8S080	4.5292	1.1966

Maintenance and Cleaning

The 2537 requires very little maintenance.

- If the paddlewheel becomes fouled, it can be cleaned with mild detergents and a small brush.
- The electronics portion of the 2537 does not require maintenance or cleaning.

Keypad Functions



Example: Press Quick Menus, use scroll down to desired option, Press OK to select

Before you program the drive for the first time reset the drive to factory condition using the following steps:

Reset Drive to Factory Settings

To insure that the drive is at factory default before you start programming:

1. Power down drive and wait for all lights to go off.
2. Press and hold: Status, Main Menu and OK.
3. Power up drive, continue holding all 3 buttons until initializing appears on the display.

New Smart Start Menu for Programing Acu Drive

Speed (RPM)

Single Speed

Speed with Automation

Speed with Scheduled Events

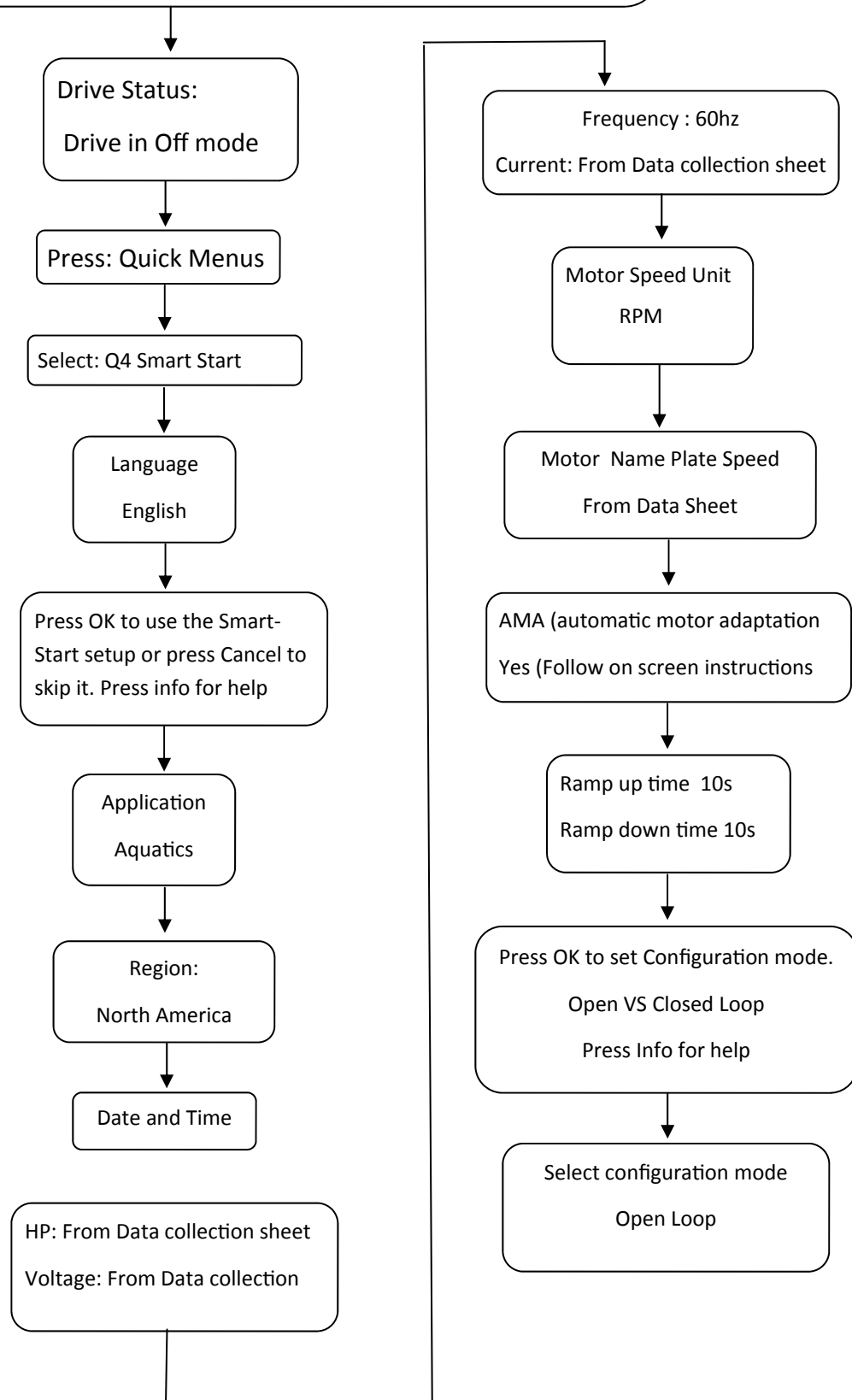
Acu Drive Programing for Single Speed

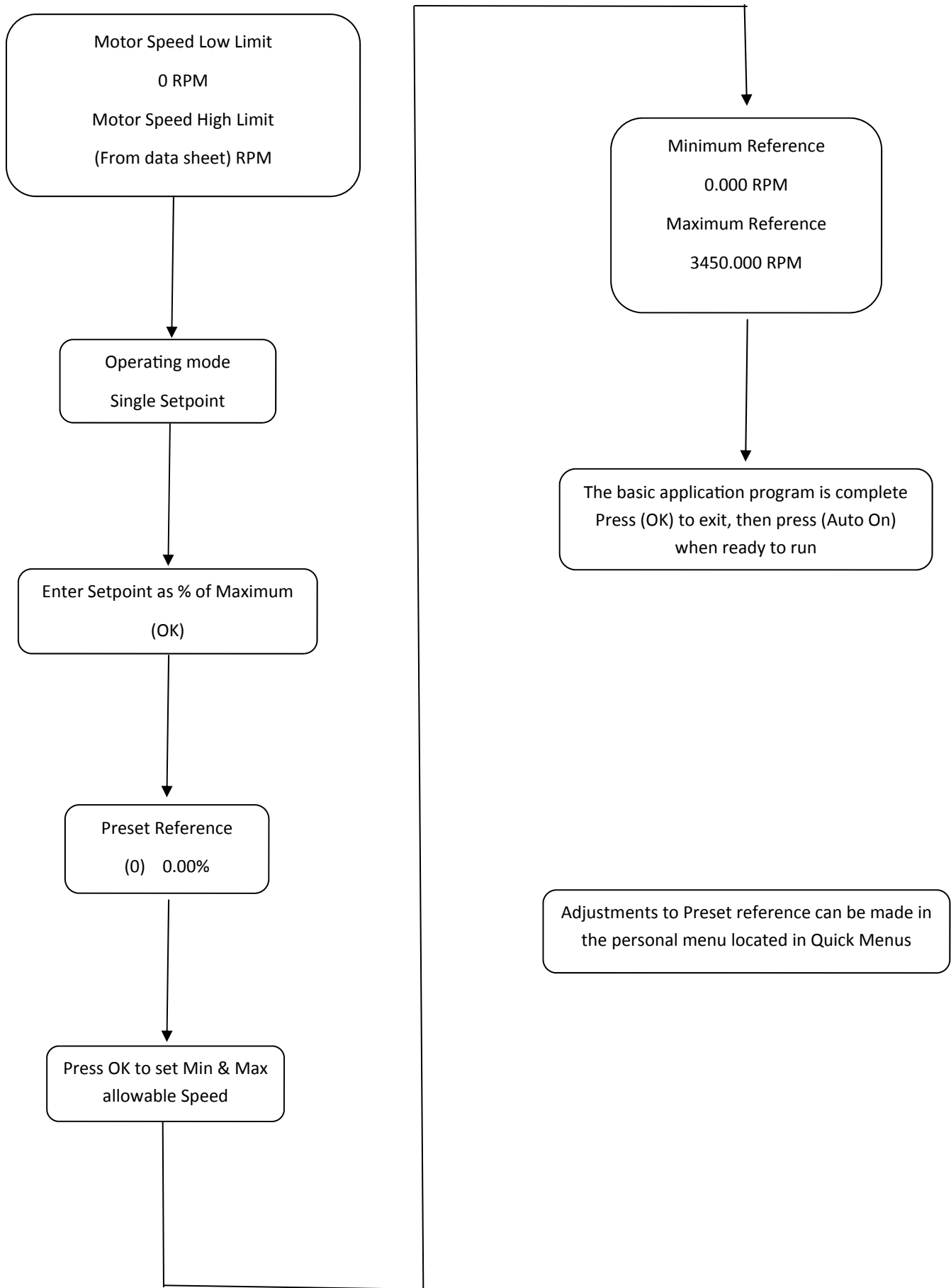
Erase drive :

Power the drive off at the fused disconnect on the drive

press and holding Status, Main Menu and OK at the same time

Power the drive up and do not release the buttons until Initializing shows up on the display.





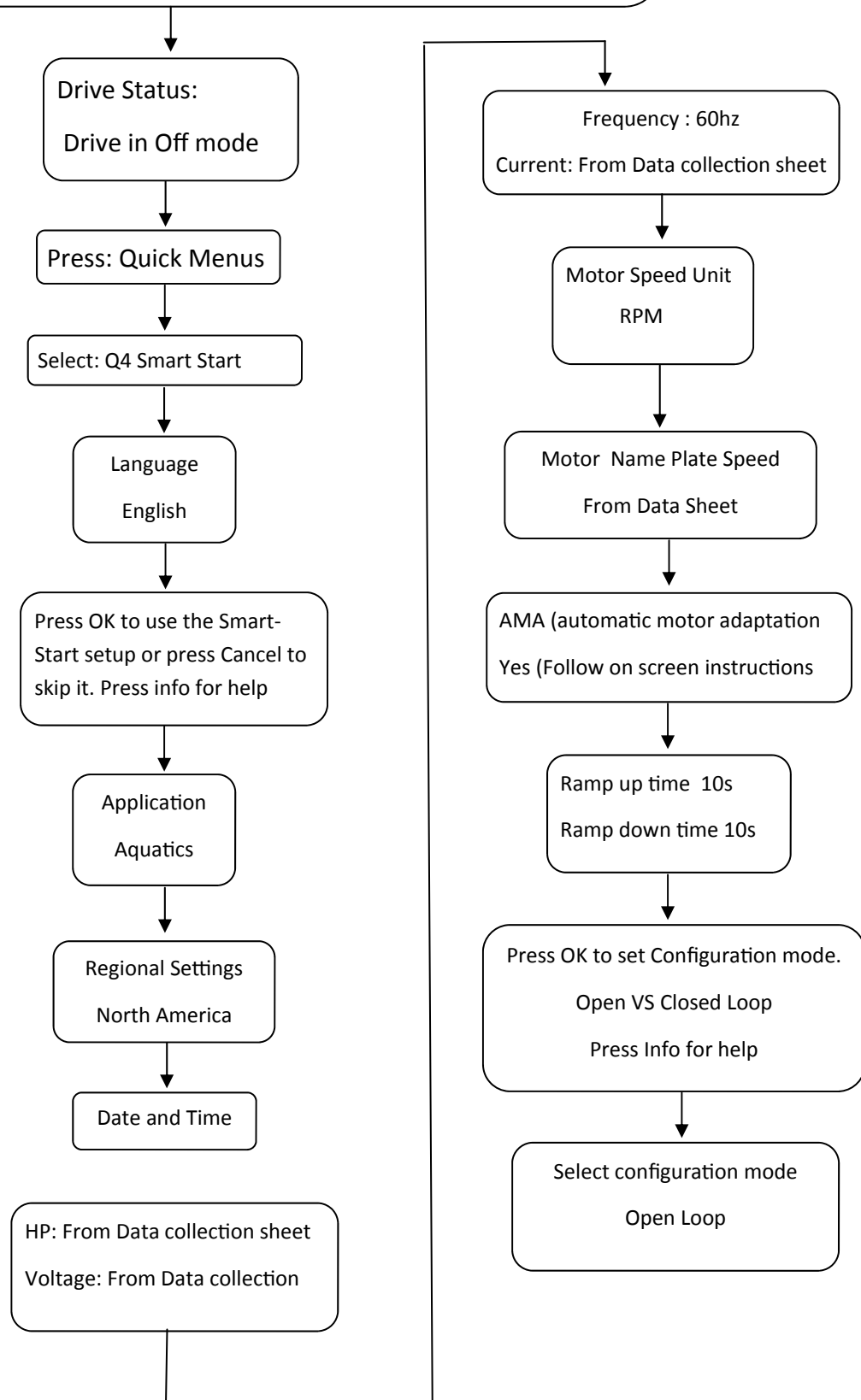
Acu Drive Programing For Speed and Automation

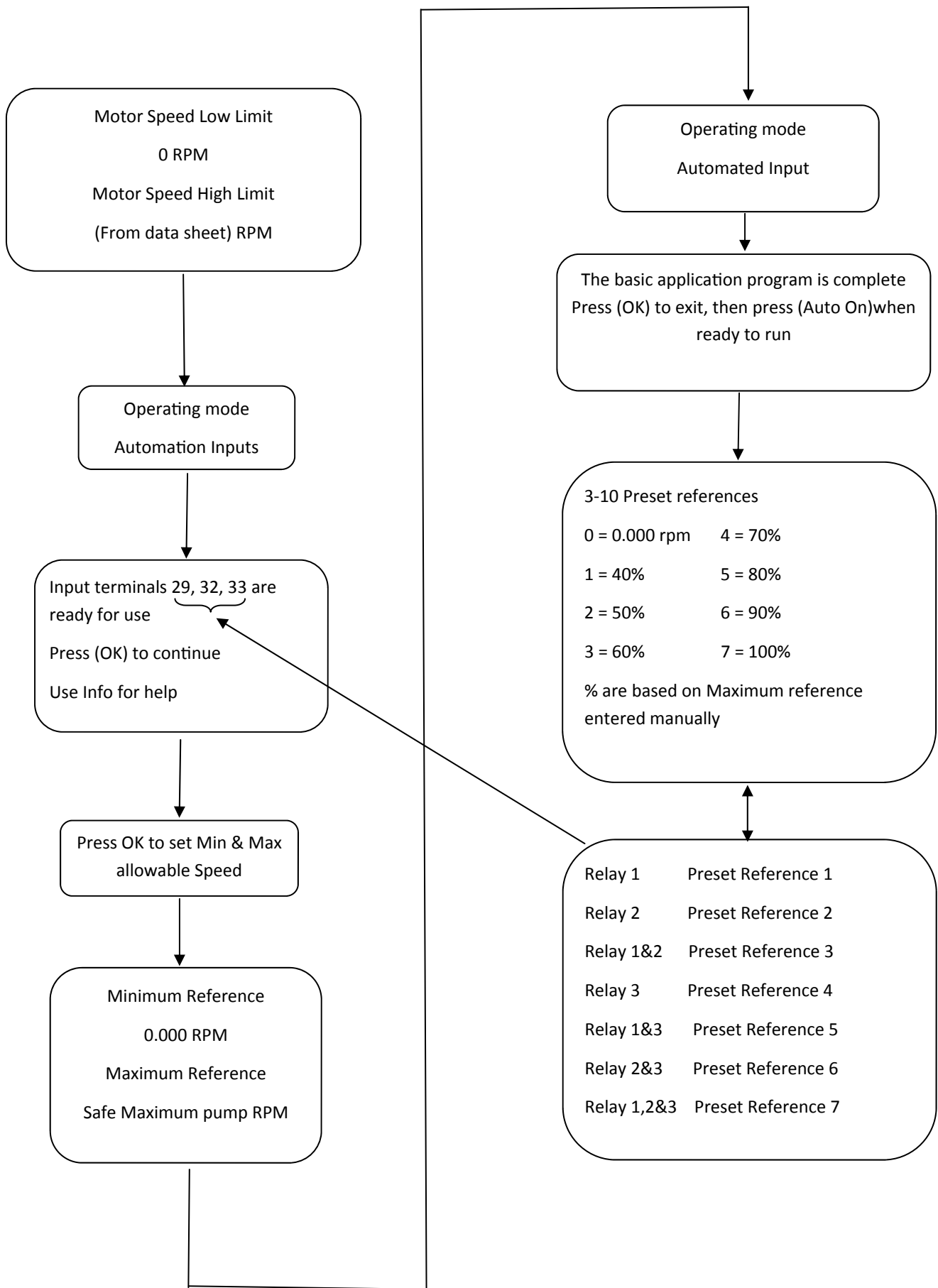
Erase drive :

Power the drive off at the fused disconnect on the drive

Press and holding Status, Main Menu and OK at the same time

Power the drive up and do not release the buttons until Initializing shows up on the display.





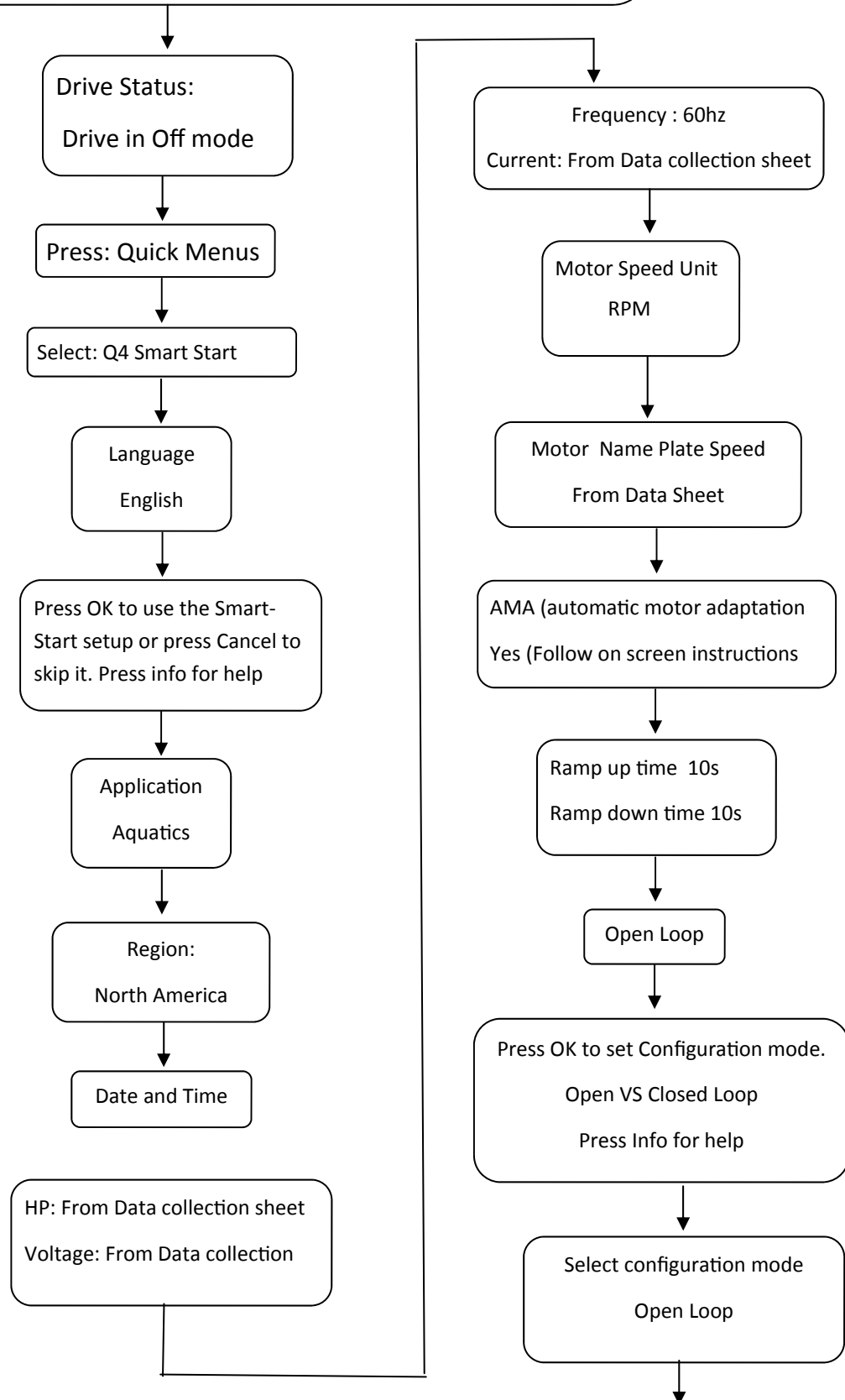
Acu Drive Programing for Speed and Schedule

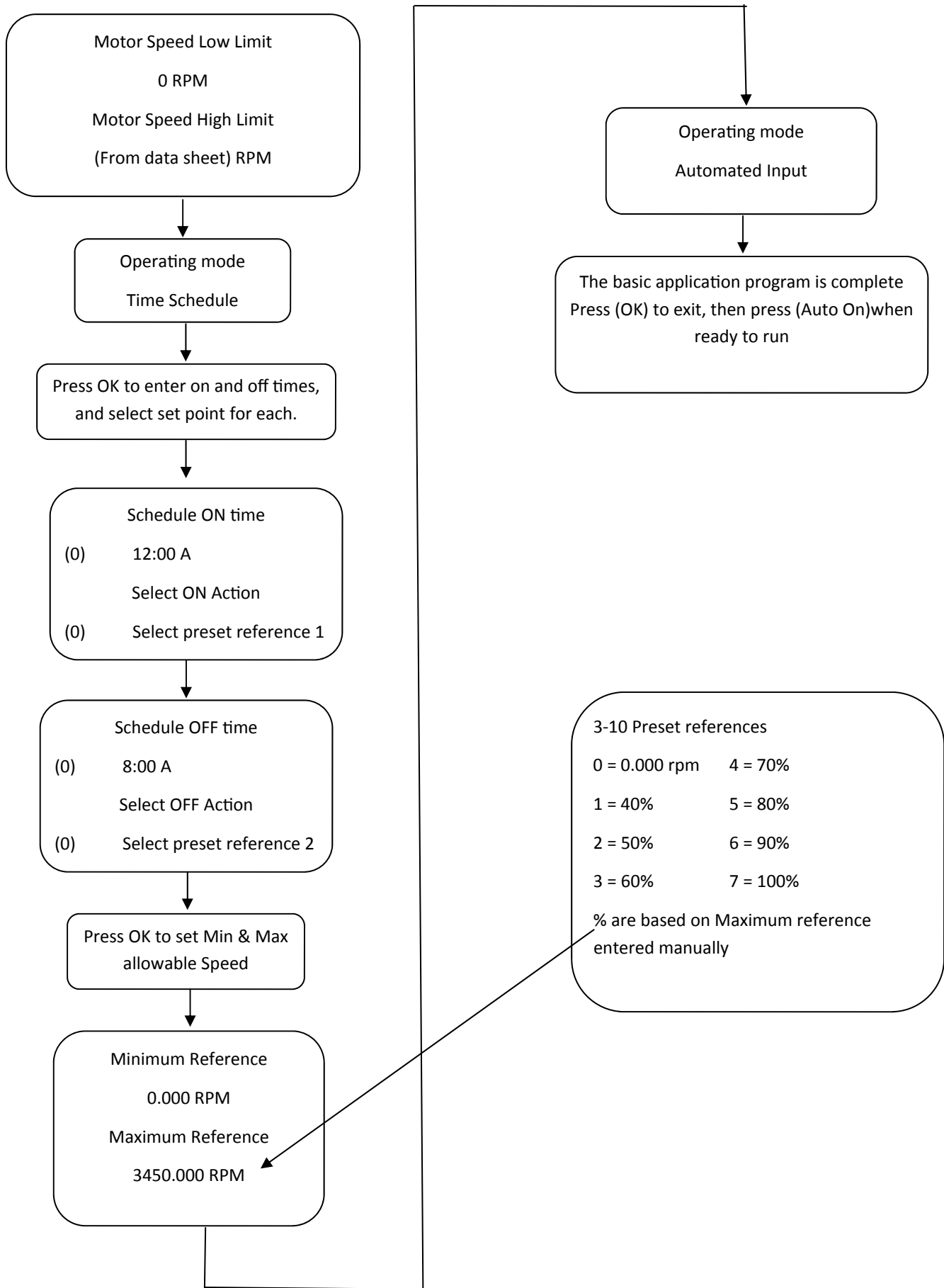
Erase drive :

Power the drive off at the fused disconnect on the drive

Press and holding Status, Main Menu and OK at the same time

Power the drive up and do not release the buttons until Initializing shows up on the display.





New Smart Start Menu for Programing Acu Drive for Flow (Using 4-10ma Flow Meters)

**Single Flow Setpoint
Multiple Flow Rates with Automation
Multiple Flow Rate Schedules**

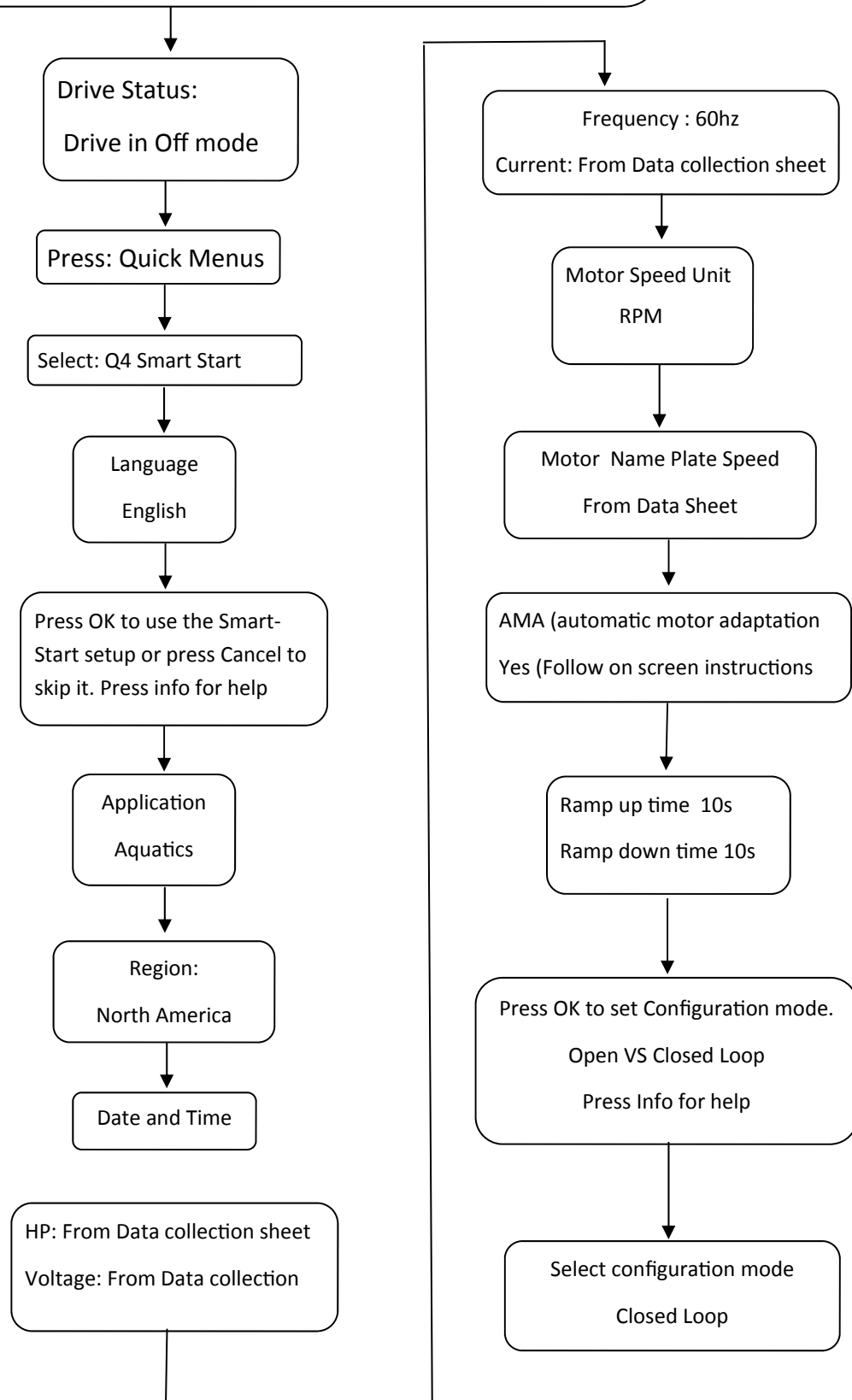
Acu Drive Programing for Single Flow Rate

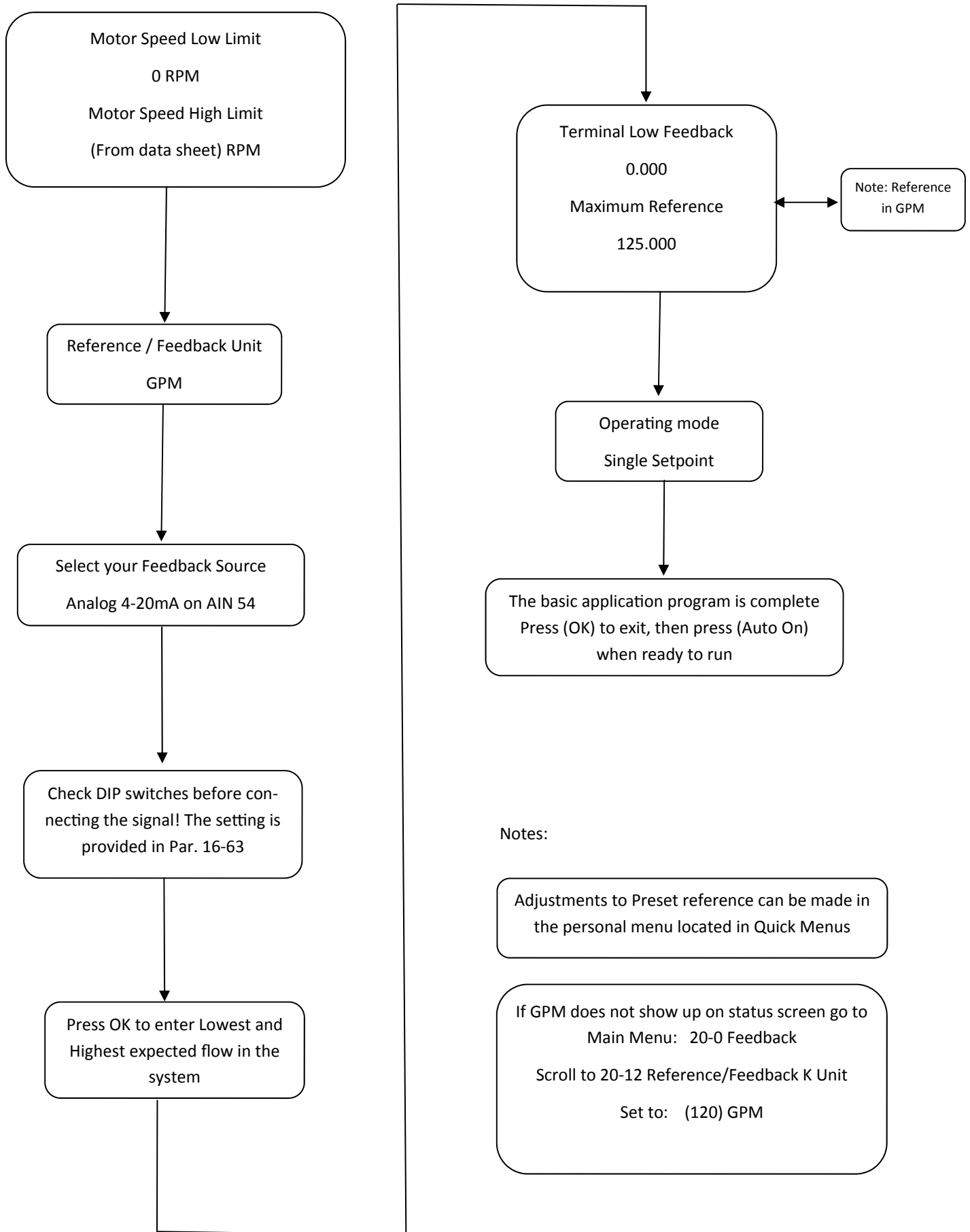
Erase drive :

Power the drive off at the fused disconnect on the drive

Press and holding Status, Main Menu and OK at the same time

Power the drive up and do not release the buttons until Initializing shows up on the display.





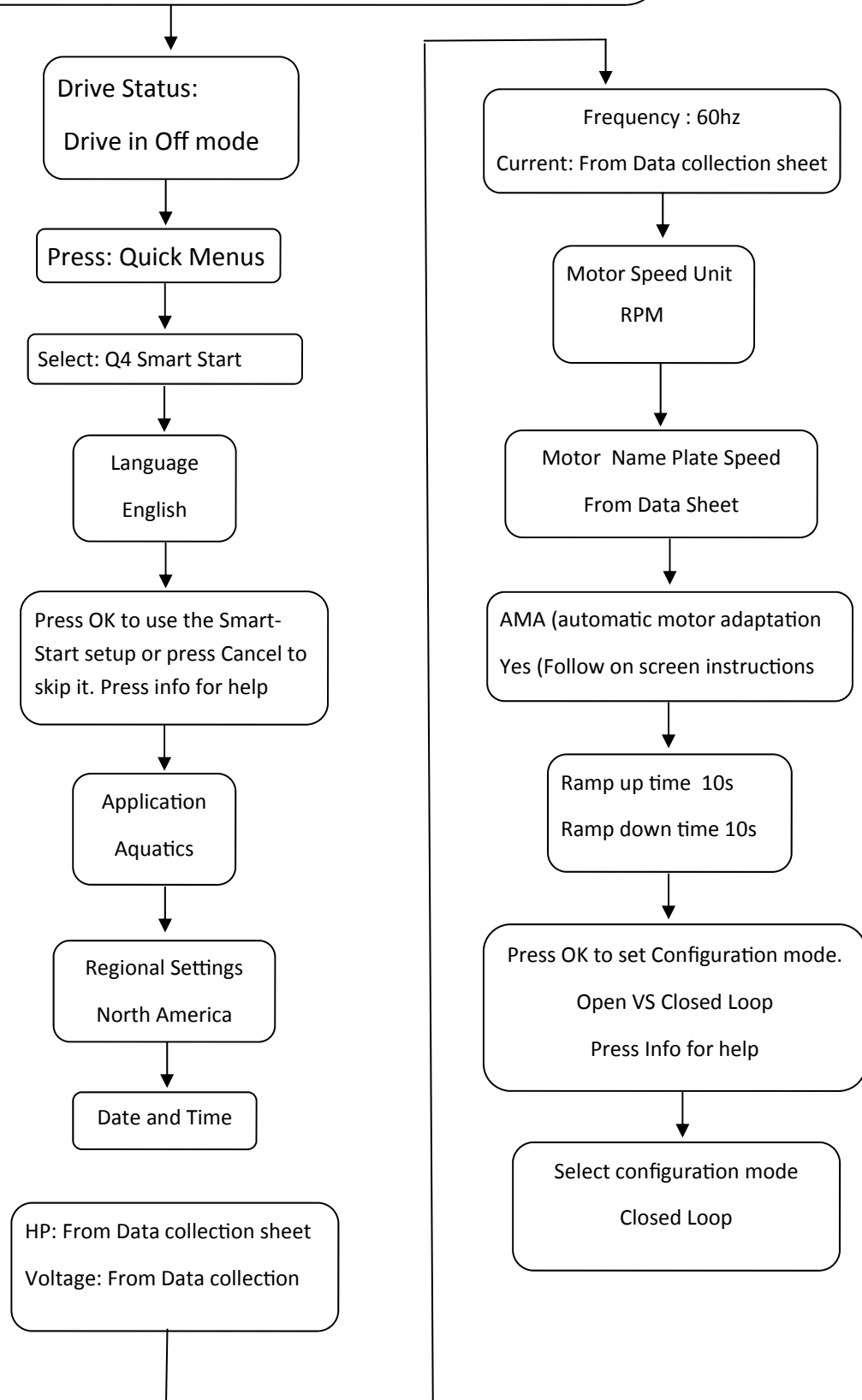
Acu Drive Programing For Flow and Automation

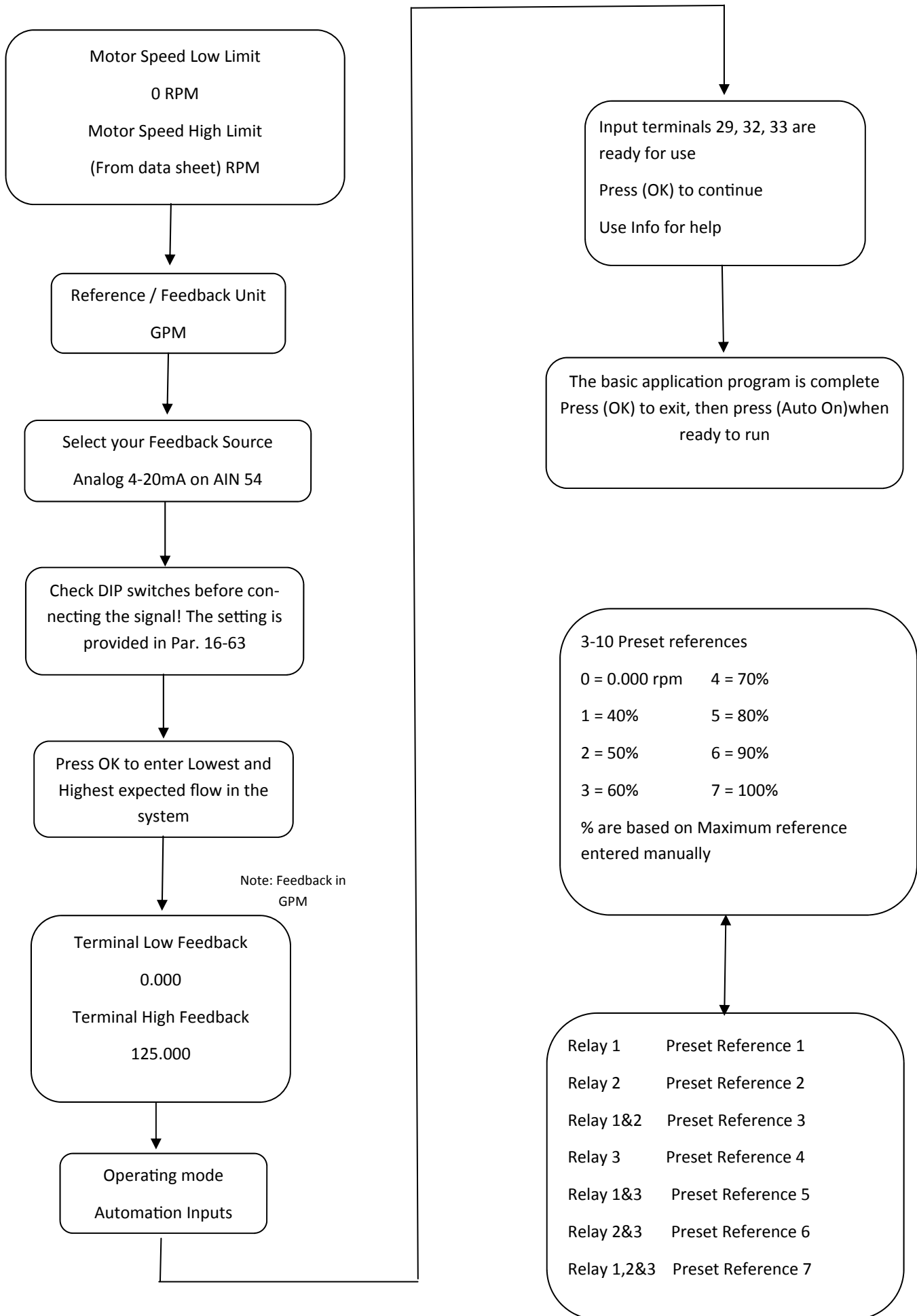
Erase drive :

Power the drive off at the fused disconnect on the drive

Press and holding Status, Main Menu and OK at the same time

Power the drive up and do not release the buttons until Initializing shows up on the display.





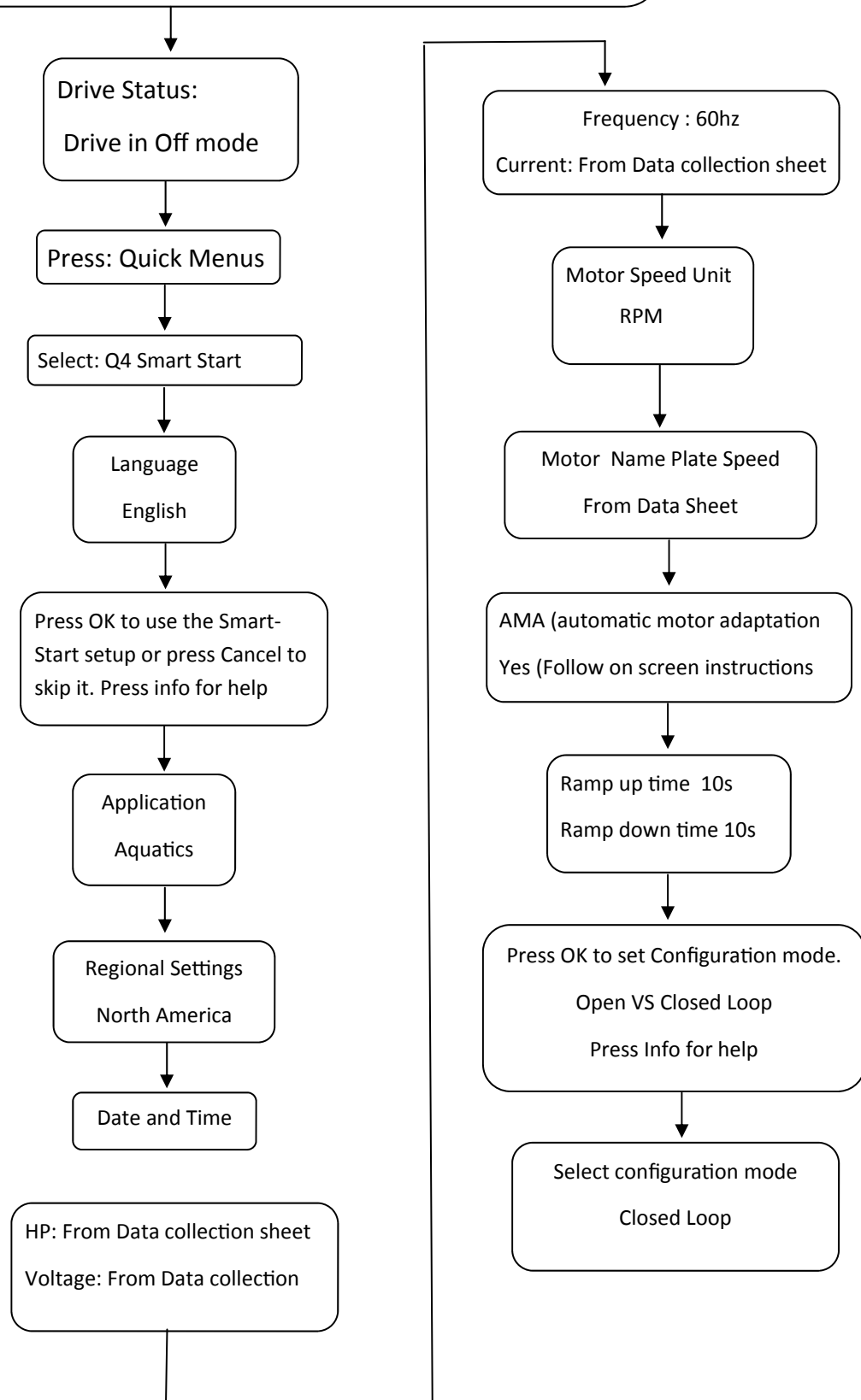
Acu Drive Programing For Flow and Schedule

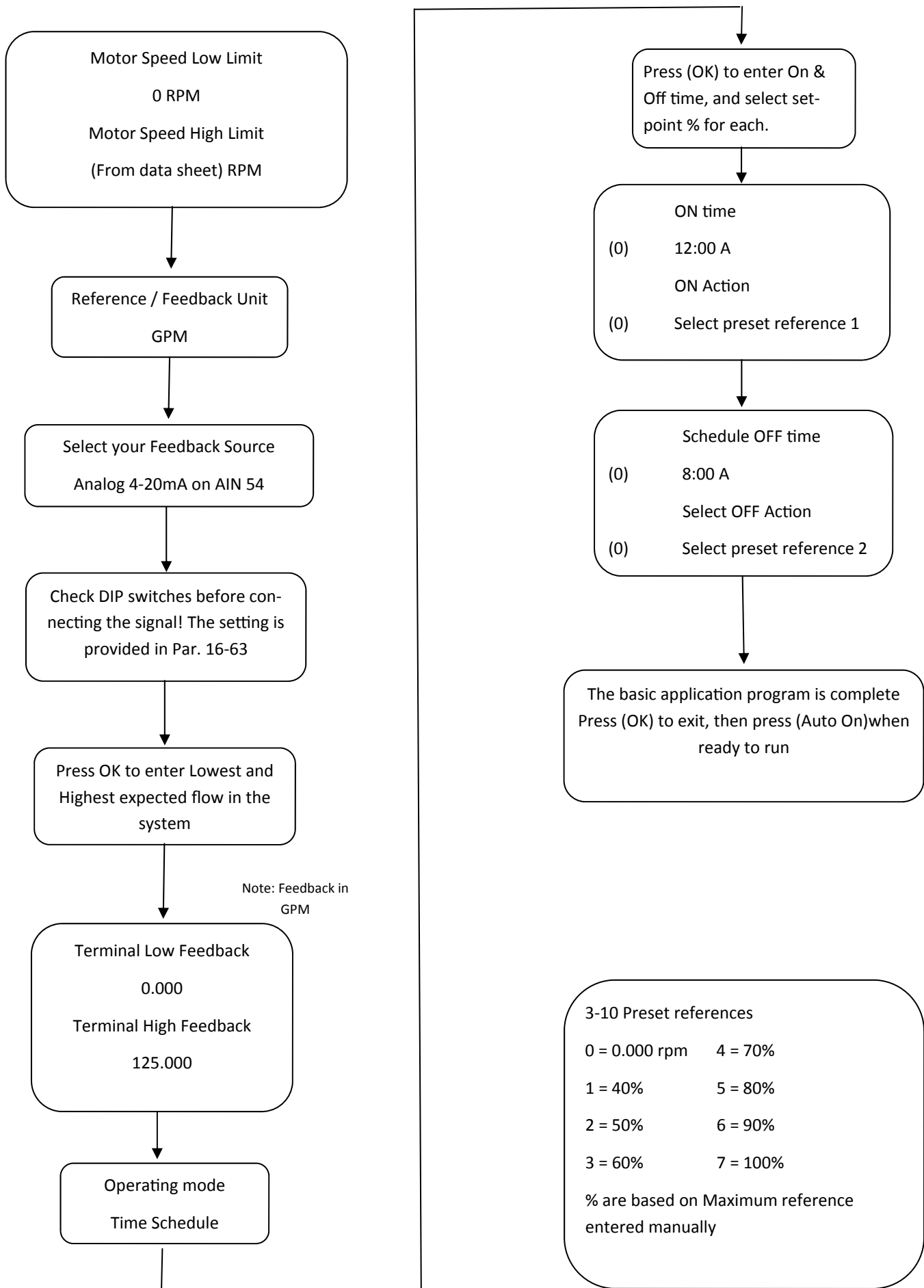
Erase drive :

Power the drive off at the fused disconnect on the drive

Press and holding Status, Main Menu and OK at the same time

Power the drive up and do not release the buttons until Initializing shows up on the display.





Entering the Motor Specific Information

- Press Quick Menus Button. It is the second of the top four buttons.
- Use Down Arrow to highlight 4-13 Motor Speed High Limit [RPM]. Press OK.

The following list will now be available for you to enter so that the Acu Drive™ XS Variable Frequency Drive will operate the motor correctly (to make it easier to enter big numbers, the right and left keys will allow you to move the cursor left or right, then enter the correct number. Up moves the numbers higher; down, lower and so forth)

0-01 Language	English US [22]
1-21 Motor Power [HP]	<i>Enter Motor Nameplate Information</i>
1-22 Motor Voltage [V]	<i>Enter Motor Nameplate Information</i>
1-23 Motor Frequency [Hz]	<i>Enter Motor Nameplate information (most likely 60)</i>
1-24 Motor Current [A]	<i>Enter Motor FLA reading</i>
1-25 Motor Nominal Speed [RPM]	<i>Enter Motor Nameplate Information</i>
3-41 Ramp 1 Ramp-up Time [s]	<i>The default setting is fine (10 sec.)</i>
3-42 Ramp 1 Ramp-down Time [s]	<i>The default setting is fine (10 sec.)</i>
4-11 Motor Speed Low Limit [RPM]	Typically 0
4-13 Motor Speed High Limit [RPM]	<i>Enter Motor Nameplate Information</i>
1-29 Automatic Motor Adaptation [AMA]	Change to [1] Enable Complete AMA (If the motor has not been off for 6 hours or more, Run [2] Enable Reduced [AMA])

- The First menu displayed is the Language. The Default is English, but the desired is [22] English US, so to change it; press OK and press the up or down Arrow until English US is highlighted, then press OK
- Now press the down key to move to Motor Power [HP]
- Press OK to change the field and enter the correct information. If you make a mistake, you can press Cancel at any time and it will return to the last saved entry.
- Continue down the list until you return to Language.

Programming the Internal Time Clock

- Press Quick Menus again and select Q3 [Function Setups], Press OK
- Select Q3-1 General Settings, Press OK
- Select Q3-10 Clock Settings, Press OK
- To make this easier to program, go down to parameter 0-71 Date Format, Press OK
- You can now have the date display in MM/DD/YYYY or any other format you desire, Press OK when your selection is done.
- Arrow Down to 0-72 [Time Format] to change clock to 1 [12 hour], Press OK
- Press the Up Arrow and go to parameter 0-70 Set Date and Time, Press OK
- Input the correct date and time, Press OK
- The clock can also be programmed to accommodate Daylight Savings Time. Press the Down Arrow until you get to 0-74 DST/Summertime Press OK
- Change to Manual, Press OK
- Press the Down Arrow until you see 0-76 DST/Summertime Start, Press OK
- Enter the beginning of DST, when done, press OK
- Press the Down Arrow to go to 0-77 DST/Summertime END, Press OK
- Enter the end of DST, when done, Press OK
- Press the Back Key

Editing Preset References

Reference and ramp settings have been set for you in Smart Start. To edit these set points follow the following steps:

1. Press Main Menu
2. Scroll down to 3-** Reference / Ramps and press OK to select
3. Scroll down to 3-1* References press OK
4. Screen will display 3-01 Preset Reference
(0)
0.00%
5. Press OK and highlight (0) use up or down arrows to see reference 0-7.
6. Press ok to highlight % of maximum rpm to make changes.
7. Press ok to save and status to see changes

Preset % for each reference is as follows:

- (0) 0.00%
- (1) 40%
- (2) 50%
- (3) 60%
- (4) 70%
- (5) 80%
- (6) 90%
- (7) 100%

***On older drives all of the preset references are set to 0.00%
and 3-0 Reference Limits must be adjusted to match pump max speed limit.***

***To calculate % of speed: Example: max speed 3450 rpm desired speed 3000 rpm
3000 divided by 3450= 0.869 (86.9%)***

-Programming the Display

- Press [Main Menu] button then select 0-** Operation / Display Scroll to 0-2* LCP Display press OK. This will allow you to select the display options you want to see on the status display.
- You will see a list of the following “places” that can offer different displays up to 5 simultaneously

Parameter	Display Examples
0-20 Display Line 1.1 Small	1601 – Reference [unit]
0-21 Display Line 1.2 Small	1664 – Analog Input 54
0-22 Display Line 1.3 Small	1617 – Speed [RPM]
0-23 Display Line 2 Large	1652 -- Feedback Unit
0-24 Display Line 3 Large	89 – Date & Time

The most common display options have been pre-programmed for you

- You can choose from many different display parameters.
- Once done, press the status button and see your new displays on the screen

Section 5: LCP Display Options

Define the variables displayed in the Graphical Local Control Panel.



NB!

Please refer to par. 0-37 *Display Text 1*, par. 0-38 *Display Text 2* and par. 0-39 *Display Text 3* for information on how to write display texts

0-20 Display Line 1.1 Small

Option:

Function:

Select a variable for display in line 1, left position.

[0]	None	No display value selected
[37]	Display Text 1	Present control word
[38]	Display Text 2	Enables an individual text string to be written, for display in the LCP or to be read via serial communication.
[39]	Display Text 3	Enables an individual text string to be written, for display in the LCP or to be read via serial communication.
[89]	Date and Time Readout	Displays the current date and time.
[953]	Profibus Warning Word	Displays Profibus communication warnings.
[1005]	Readout Transmit Error Counter	View the number of CAN control transmission errors since the last power-up.
[1006]	Readout Receive Error Counter	View the number of CAN control receipt errors since the last power-up.
[1007]	Readout Bus Off Counter	View the number of Bus Off events since the last power-up.
[1013]	Warning Parameter	View a DeviceNet-specific warning word. One separate bit is assigned to every warning.
[1115]	LON Warning Word	Shows the LON-specific warnings.

[1117]	XIF Revision	Shows the version of the external interface file of the Neuron C chip on the LON option.
[1118]	LON Works Revision	Shows the software version of the application program of the Neuron C chip on the LON option.
[1500]	Operating Hours	View the number of running hours of the frequency converter.
[1501]	Running Hours	View the number of running hours of the motor.
[1502]	kWh Counter	View the mains power consumption in kWh.
[1600]	Control Word	View the Control Word sent from the frequency converter via the serial communication port in hex code.
[1601] *	Reference [Unit]	Total reference (sum of digital/analog/preset/bus/freeze ref./catch up and slow-down) in selected unit.
[1602]	Reference %	Total reference (sum of digital/analog/preset/bus/freeze ref./catch up and slow-down) in percent.
[1603]	Status Word	Present status word
[1605]	Main Actual Value [%]	One or more warnings in a Hex code
[1609]	Custom Readout	View the user-defined readouts as defined in par. 0-30, 0-31 and 0-32.
[1610]	Power [kW]	Actual power consumed by the motor in kW.
[1611]	Power [hp]	Actual power consumed by the motor in HP.
[1612]	Motor Voltage	Voltage supplied to the motor.
[1613]	Motor Frequency	Motor frequency, i.e. the output frequency from the frequency converter in Hz.
[1614]	Motor Current	Phase current of the motor measured as effective value.
[1615]	Frequency [%]	Motor frequency, i.e. the output frequency from the frequency converter in percent.
[1616]	Torque [Nm]	Present motor load as a percentage of the rated motor torque.
[1617]	Speed [RPM]	Speed in RPM (revolutions per minute) i.e. the motor shaft speed in closed loop based on the entered motor nameplate data, the output frequency and the load on the frequency converter.
[1618]	Motor Thermal	Thermal load on the motor, calculated by the ETR function. See also parameter group 1-9* Motor Temperature.
[1622]	Torque [%]	Shows the actual torque produced, in percentage.
[1630]	DC Link Voltage	Intermediate circuit voltage in the frequency converter.
[1632]	BrakeEnergy/s	Present brake power transferred to an external brake resistor. Stated as an instantaneous value.
[1633]	BrakeEnergy/2 min	Brake power transferred to an external brake resistor. The mean power is calculated continuously for the most recent 120 seconds.
[1634]	Heatsink Temp.	Present heat sink temperature of the frequency converter. The cut-out limit is 95 ±5 °C; cutting back in occurs at 70 ±5° C.
[1635]	Thermal Drive Load	Percentage load of the inverters
[1636]	Inv. Nom. Current	Nominal current of the frequency converter
[1637]	Inv. Max. Current	Maximum current of the frequency converter
[1638]	SL Control State	State of the event executed by the control
[1639]	Control Card Temp.	Temperature of the control card.
[1650]	External Reference	Sum of the external reference as a percentage, i.e. the sum of analog/pulse/bus.
[1652]	Feedback [Unit]	Signal value in units from the programmed digital input(s).
[1653]	Digi Pot Reference	View the contribution of the digital potentiometer to the actual reference Feedback.
[1654]	Feedback 1 [Unit]	View the value of Feedback 1. See also par. 20-0*.
[1655]	Feedback 2 [Unit]	View the value of Feedback 2. See also par. 20-0*.
[1656]	Feedback 3 [Unit]	View the value of Feedback 3. See also par. 20-0*.
[1658]	PID Output [%]	Returns the Drive Closed Loop PID controller output value in percent.
[1659]	Adjusted Setpoint	Displays the actual operating set-point after it is modified by flow compensation. See parameters 22-8*.
[1660]	Digital Input	Displays the status of the digital inputs. Signal low = 0; Signal high = 1. Regarding order, see par. 16-60. Bit 0 is at the extreme right.
[1661]	Terminal 53 Switch Setting	Setting of input terminal 53. Current = 0; Voltage = 1.

[1662]	Analog Input 53	Actual value at input 53 either as a reference or protection value.
[1663]	Terminal 54 Switch Setting	Setting of input terminal 54. Current = 0; Voltage = 1.
[1664]	Analog Input 54	Actual value at input 54 either as reference or protection value.
[1665]	Analog Output 42 [mA]	Actual value at output 42 in mA. Use par. 6-50 to select the variable to be represented by output 42.
[1666]	Digital Output [bin]	Binary value of all digital outputs.
[1667]	Freq. Input #29 [Hz]	Actual value of the frequency applied at terminal 29 as a pulse input.
[1668]	Freq. Input #33 [Hz]	Actual value of the frequency applied at terminal 33 as a pulse input.
[1669]	Pulse Output #27 [Hz]	Actual value of pulses applied to terminal 27 in digital output mode.
[1670]	Pulse Output #29 [Hz]	Actual value of pulses applied to terminal 29 in digital output mode.
[1671]	Relay Output [bin]	View the setting of all relays.
[1672]	Counter A	View the present value of Counter A.
[1673]	Counter B	View the present value of Counter B.
[1675]	Analog input X30/11	Actual value of the signal on input X30/11 (General Purpose I/O Card. Option)
[1676]	Analog input X30/12	Actual value of the signal on input X30/12 (General Purpose I/O Card. Optional)
[1677]	Analog output X30/8 [mA]	Actual value at output X30/8 (General Purpose I/O Card. Optional) Use Par. 6-60 to select the variable to be shown.
[1680]	Fieldbus CTW 1	Control word (CTW) received from the Bus Master.
[1682]	Fieldbus REF 1	Main reference value sent with control word via the serial communications network e.g. from the BMS, PLC or other master controller.
[1684]	Comm. Option STW	Extended fieldbus communication option status word.
[1685]	FC Port CTW 1	Control word (CTW) received from the Bus Master.
[1686]	FC Port REF 1	Status word (STW) sent to the Bus Master.
[1690]	Alarm Word	One or more alarms in a Hex code (used for serial communications)
[1691]	Alarm Word 2	One or more alarms in a Hex code (used for serial communications)
[1692]	Warning Word	One or more warnings in a Hex code (used for serial communications)
[1693]	Warning Word 2	One or more warnings in a Hex code (used for serial communications)
[1694]	Ext. Status Word	One or more status conditions in a Hex code (used for serial communications)
[1695]	Ext. Status Word 2	One or more status conditions in a Hex code (used for serial communications)
[1696]	Maintenance Word	The bits reflect the status for the programmed Preventive Maintenance Events in parameter group 23-1*
[1830]	Analog Input X42/1	Shows the value of the signal applied to terminal X42/1 on the Analog I/O card.
[1831]	Analog Input X42/3	Shows the value of the signal applied to terminal X42/3 on the Analog I/O card.
[1832]	Analog Input X42/5	Shows the value of the signal applied to terminal X42/5 on the Analog I/O card.
[1833]	Analog Out X42/7 [V]	Shows the value of the signal applied to terminal X42/7 on the Analog I/O card.
[1834]	Analog Out X42/9 [V]	Shows the value of the signal applied to terminal X42/9 on the Analog I/O card.
[1835]	Analog Out X42/11 [V]	Shows the value of the signal applied to terminal X42/11 on the Analog I/O card.
[2117]	Ext. 1 Reference [Unit]	The value of the reference for extended Closed Loop Controller 1
[2118]	Ext. 1 Feedback [Unit]	The value of the feedback signal for extended Closed Loop Controller 1
[2119]	Ext. 1 Output [%]	The value of the output from extended Closed Loop Controller 1
[2137]	Ext. 2 Reference [Unit]	The value of the reference for extended Closed Loop Controller 2
[2138]	Ext. 2 Feedback [Unit]	The value of the feedback signal for extended Closed Loop Controller 2
[2139]	Ext. 2 Output [%]	The value of the output from extended Closed Loop Controller 2
[2157]	Ext. 3 Reference [Unit]	The value of the reference for extended Closed Loop Controller 3
[2158]	Ext. 3 Feedback [Unit]	The value of the feedback signal for extended Closed Loop Controller 3
[2159]	Ext. Output [%]	The value of the output from extended Closed Loop Controller 3
[2230]	No-Flow Power	The calculated No Flow Power for the actual operating speed
[2580]	Cascade Status	Status for the operation of the Cascade Controller

Section 6: Fault Messages and Error Codes

WARNING 1, 10 Volts low:

The 10 V voltage from terminal 50 on the control card is below 10 V. Remove some of the load from terminal 50, as the 10 V supply is overloaded. Max. 15 mA or minimum 590 Ω.

WARNING/ALARM 2, Live zero error:

The signal on terminal 53 or 54 is less than 50% of the value set in par. 6-10 *Terminal 53 Low Voltage*, par. 6-12 *Terminal 53 Low Current*, par. 6-20 *Terminal 54 Low Voltage*, or par. 6-22 *Terminal 54 Low Current* respectively.

WARNING/ALARM 3, No motor:

No motor has been connected to the output of the frequency converter.

WARNING/ALARM 4, Mains phase loss:

A phase is missing on the supply side, or the mains voltage imbalance is too high.

This message also appears in case of a fault in the input rectifier on the frequency converter.

Check the supply voltage and supply currents to the frequency converter.

WARNING 5, DC link voltage high:

The intermediate circuit voltage (DC) is higher than the over-voltage limit of the control system. The frequency converter is still active.

WARNING 6, DC link voltage low:

The intermediate circuit voltage (DC) is below the undervoltage limit of the control system. The frequency converter is still active.

WARNING/ALARM 7, DC over voltage:

If the intermediate circuit voltage exceeds the limit, the frequency converter trips after a time.

Possible corrections:

Select **Over Voltage Control** function in par. 2-17 *Over-voltage Control*

Connect a brake resistor

Extend the ramp time

Activate functions in par. 2-10 *Brake Function*

Increase par. 14-26 *Trip Delay at Inverter Fault*

Selecting OVC function will extend the ramp times.

Alarm/warning limits:			
Voltage Range	3 x 200-240 VAC [VDC]	3 x 380-500 VAC [VDC]	3 x 550-600 VAC [VDC]
Under voltage	185	373	532
Voltage warning low	205	410	585
Voltage warning high (w/o brake - w/ brake)	390/405	810/840	943/965
Over voltage	410	855	975

The voltages stated are the intermediate circuit voltage of the frequency converter with a tolerance of ± 5 %. The corresponding mains voltage is the intermediate circuit voltage (DC-link) divided by 1.35

WARNING/ALARM 8, DC under voltage:

If the intermediate circuit voltage (DC) drops below the "voltage warning low" limit (see table above), the frequency converter checks if 24 V backup supply is connected.

If no 24 V backup supply is connected, the frequency converter trips after a given time depending on the unit.

To check whether the supply voltage matches the frequency converter, see 3.1 *General Specifications*.

WARNING/ALARM 9, Inverter overloaded:

The frequency converter is about to cut out because of an overload (too high current for too long). The counter for electronic, thermal inverter protection gives a warning at 98% and trips at 100%, while giving an alarm. You cannot reset the frequency converter until the counter is below 90%.

The fault is that the frequency converter is overloaded by more than nominal current for too long.

WARNING/ALARM 10, Motor ETR over temperature:

According to the electronic thermal protection (ETR), the motor is too hot. You can choose if you want the frequency converter to give a warning or an alarm when the counter reaches 100% in par. 1-90 *Motor Thermal Protection*. The fault is that the motor is overloaded by more than nominal current for too long. Check that the motor par.1-24 *Motor Current* is set correctly.

WARNING/ALARM 11, Motor thermistor over temp:

The thermistor or the thermistor connection is disconnected. You can choose if you want the frequency converter to give a warning or an alarm in par. 1-90 *Motor Thermal Protection*. Check that the thermistor is connected correctly between terminal 53 or 54 (analog voltage input) and terminal 50 (+ 10 Volts supply), or between terminal 18 or 19 (digital input PNP only) and terminal 50. If a KTY sensor is used, check for correct connection between terminal 54 and 55.

WARNING/ALARM 12, Torque limit:

The torque is higher than the value in par. 4-16 *Torque Limit Motor Mode* (in motor operation) or the torque is higher than the value in par. 4-17 *Torque Limit Generator Mode* (in regenerative operation).

WARNING/ALARM 13, Over Current:

The inverter peak current limit (approx. 200% of the rated current) is exceeded. The warning will last approx. 8-12 sec., then the frequency converter trips and issues an alarm. Turn off the frequency converter and check if the motor shaft can be turned and if the motor size matches the frequency converter.

ALARM 14, Earth fault:

There is a discharge from the output phases to earth, either in the cable between the frequency converter and the motor or in the motor itself. Turn off the frequency converter and remove the earth fault.

ALARM 15, In-complete hardware:

A fitted option is not handled by the present control board (hardware or software).

ALARM 16, Short-circuit:

There is short-circuiting in the motor or on the motor terminals.

Turn off the frequency converter and remove the short-circuit.

WARNING/ALARM 17, Control word timeout:

There is no communication to the frequency converter.

The warning will only be active when par. 8-04 *Control Timeout Function* is NOT set to *OFF*.

If par. 8-04 *Control Timeout Function* is set to *Stop* and *Trip*, a warning appears and the frequency converter ramps down to zero speed, while giving an alarm.

par. 8-03 *Control Timeout Time* could possibly be increased.

WARNING 23, Internal fans:

External fans have failed due to defect hardware or fans not mounted.

WARNING 24, External fan fault:

The fan warning function is an extra protection function that checks if the fan is running / mounted. The fan warning can be disabled in par. 14-53 *Fan Monitor*, [0] Disabled.

WARNING 25, Brake resistor short-circuited:

The brake resistor is monitored during operation. If it short-circuits, the brake function is disconnected and the warning appears. The frequency converter still works, but without the brake function. Turn off the frequency converter and replace the brake resistor (see par. 2-15 *Brake Check*).

ALARM / WARNING 26, Brake resistor power limit:

The power transmitted to the brake resistor is calculated as a percentage, as a mean value over the last 120 s, on the basis of the resistance value of the brake resistor (par. 2-11 *Brake Resistor (ohm)*) and the intermediate circuit voltage. The warning is active when the dissipated braking power is higher than 90%. If *Trip* [2] has been selected in par. 2-13 *Brake Power Monitoring*, the frequency converter cuts out and issues this alarm, when the dissipated braking power is higher than 100%.

WARNING / ALARM 27, Brake chopper fault:

The brake transistor is monitored during operation and if it short-circuits, the brake function disconnects and the warning comes up. The frequency converter is still able to run, but since the brake transistor has short-circuited, substantial power is transmitted to the brake resistor, even if it is inactive.

Turn off the frequency converter and remove the brake resistor.



Warning: There is a risk of substantial power being transmitted to the brake resistor if the brake transistor is short-circuited.

ALARM / WARNING 28, Brake check failed:

Brake resistor fault: the brake resistor is not connected/working.

WARNING / ALARM 29, Drive over temperature:

If the enclosure is IP00 or IP20/Nema1 the cut-out temperature of the heat-sink is 90 °C. If IP54 is used, the cut-out temperature is 80 °C.

The fault could be:

- Ambient temperature too high
- Too long motor cable

ALARM 30, Motor phase U missing:

Motor phase U between the frequency converter and the motor is missing.

Turn off the frequency converter and check motor phase U.

ALARM 31, Motor phase V missing:

Motor phase V between the frequency converter and the motor is missing. Turn off the frequency converter and check motor phase V.

ALARM 32, Motor phase W missing:

Motor phase W between the frequency converter and the motor is missing.

Turn off the frequency converter and check motor phase W.

ALARM 33, Inrush fault:

Too many powerups have occurred within a short time period. See the chapter *General Specifications* for the allowed number of power-ups within one minute.

WARNING / ALARM 34, Fieldbus communication fault:

The fieldbus on the communication option card is not working.

WARNING / ALARM 35, Option Fault:

Option fault. Please contact your supplier.

WARNING / ALARM 36, Mains failure:

This warning/alarm is only active if the supply voltage to the frequency converter is lost and parameter 14-10 is NOT set to OFF. Possible correction: check the fuses to the frequency converter

WARNING / ALARM 37, Phase Imbalance:

There is a current imbalance between the power units.

ALARM 39, Heatsink Sensor:

No feedback from the heatsink sensor.

WARNING 40, Overload of Digital Output Terminal 27

Check the load connected to terminal 27 or remove short-circuit connection. Check parameters 5-00 and 5-01.

WARNING 41, Overload of Digital Output Terminal 29:

Check the load connected to terminal 29 or remove short-circuit connection. Check parameters 5-00 and 5-02.

WARNING 42, Overload of Digital Output On X30/6 :

Check the load connected to X30/6 or remove short-circuit connection. Check parameter 5-32.

WARNING 42, Overload of Digital Output On X30/7 :

Check the load connected to X30/7 or remove short-circuit connection. Check parameter 5-33.

ALARM 46, Pwr. card supply:

The supply on the power card is out of range.

WARNING 47, 24 V supply low:

The external 24 V DC backup power supply may be overloaded, otherwise contact your Danfoss supplier.

ALARM 48, 1.8 V supply low:

Contact your Danfoss supplier.

WARNING 49, Speed limit:

The speed has been limited by range in par.4-11 *Motor Speed Low Limit [RPM]* and par.4-13 *Motor Speed High Limit [RPM]*.

ALARM 50, AMA calibration failed:

Contact your Danfoss supplier.

ALARM 51, AMA check Unom and Inom:

The setting of motor voltage, motor current, and motor power is presumably wrong. Check the settings.

ALARM 52, AMA low Inom:

The motor current is too low. Check the settings.

ALARM 53, AMA motor too big:

The motor is too big for the AMA to be carried out.

ALARM 54, AMA motor too small:

The motor is too small for the AMA to be carried out.

ALARM 55, AMA par. out of range:

The par. values found from the motor are outside acceptable range.

ALARM 56, AMA interrupted by user:

The AMA has been interrupted by the user.

ALARM 57, AMA timeout:

Try to start the AMA again a number of times, until the AMA is carried out. Please note that repeated runs may heat the motor to a level where the resistance R_s and R_r are increased. In most cases, however, this is not critical.

WARNING/ALARM 58, AMA internal fault:

Contact your Danfoss supplier.

WARNING 59, Current limit:

The current is higher than the value in par. 4-18 *Current Limit*.

WARNING 60, External Interlock:

External Interlock has been activated. To resume normal operation, apply 24 VDC to the terminal programmed for External Interlock and reset the frequency converter (via Bus, Digital I/O or by pressing [Reset]).

WARNING 62, Output Frequency at Maximum Limit:

The output frequency is limited by the value set in par. 4-19 *Max Output Frequency*.

WARNING/ALARM/TRIP 65, Control Card Over Temperature:

Control card over temperature: The cut-out temperature of the control card is 80° C.

WARNING 66, Low Temp.:

The heat sink temperature is measured to be low. This could indicate that the temperature sensor is defective and thus the fan speed is increased to the maximum in case the power part or control card is very hot.

ALARM 67, Option Configuration has Changed:

One or more options has either been added or removed since the last power-down.

ALARM 68, Safe Stop:

Safe Stop has been activated. To resume normal operation, apply 24 VDC to terminal 37 then send a Reset signal (via Bus, Digital I/O or by pressing [Reset]).

ALARM 69, Pwr. Card Temp:

Power card over temperature.

WARNING 76, Power Unit Setup:

The required number of power units does not match the detected number of active power units.

ALARM 70, Illegal Frequency Converter Configuration:

Actual combination of control board and power board is illegal.

ALARM 90, Feedback Mon.:**ALARM 92, NoFlow:**

A no load situation has been detected for the system. See parameter group 22-2*.

ALARM 93, Dry Pump:

A no flow situation and high speed indicates that the pump has run dry. See parameter group 22-2*

ALARM 94, End of Curve:

Feed back stays lower than the set point, which may be indicates a leakage in the pipe system. See parameter group 22-5*

ALARM 95, Broken Belt:

Torque is below the torque level set for no load indicating a broken belt. See parameter group 22-6*

ALARM 96, Start Delayed:

Start of the motor has been delayed due to short cycle protection is active. See parameter group 22-7*.

ALARM 220, Overload Trip:

Motor overload has tripped. Indicates excess motor load. Check motor and driven load. To reset press the "Off Reset" key. Then, to restart the system, press the "Auto On" or "Hand On" key.

WARNING/ALARM 243, Brake IGBT:

The brake transistor is short-circuited or the brake function is disconnected. Turn off the frequency converter as a fire precaution. Report value indicates source of alarm (from left): 1-4 Inverter 5-8 Rectifier.

WARNING/ALARM 244, Heatsink Temp:

Drive heatsink over temperature: Report value indicates source of alarm (from left): 1-4 Inverter 5-8 Rectifier.

ALARM 245, Heatsink Sensor:

No feedback from the heatsink sensor Report value indicates source of alarm (from left): 1-4 Inverter 5-8 Rectifier.

ALARM 246, Pwr. Card Supply:

The supply on the power card is out of range Report value indicates source of alarm (from left): 1-4 Inverter 5-8 Rectifier.

ALARM 247, Pwr. Card Temp:

Power card over temperature Report value indicates source of alarm (from left): 1-4 Inverter 5-8 Rectifier.

ALARM 248, Illegal PS Config:

Power size configuration fault on the power card Report value indicates source of alarm (from left): 1-4 Inverter 5-8 Rectifier.

ALARM 250, New Spare Part:

The power or Switch Mode Power Supply has been exchanged. The frequency converter type code must be restored in the EEPROM. Select the correct type code in Par 14-23 according to the label on unit. Remember to select 'Save to EEPROM' to complete.

ALARM 251, New Type Code:

The frequency converter has got a new type code.

**For Acu Drives without Smart
Start programming options
Use the following Quick Start
Guides for initial programming**

Quick Start Guide

Reset Drive to Factory Settings

To insure that the drive is at factory default before you start programming:

1. Power down drive and wait for all lights to go off.
2. Press and hold: Status, Main Menu and OK.
3. Power up drive, continue holding all 3 buttons for five seconds then release.



ACU DRIVE™ XS Variable Frequency Drive Quick Start Programming and Wiring Guide

Programming the Drive

STEP 1: Setting Location

1. Press twice to display **0-** Operation / Display**
2. Press to display **0-0* Basic Settings**
3. Press
4. Press twice to display **0-03 Regional Settings**
5. Press
6. Press to display **[1] North America**
7. Press

STEP 2: Setting Motor Parameters

1. Press
2. Press to display **Q2 Quick Setup**
3. Press to display **0-01 Language**
4. Press and then or to change setting
5. Press to save desired setting.
6. Press to display **1-21 Motor Power [HP]**. Repeat actions 4 and 5 above to set Motor HP.
7. Press to display **1-22 Motor Voltage**. Repeat actions 4 and 5 above to set Facility Measured Voltage.
8. Press to display **1-23 Motor Frequency**. Repeat actions 4 and 5 above to set Motor Frequency (60Hz).
9. Press to display **1-24 Motor Current**. Repeat actions 4 and 5 above to set Motor Name Plate Amps.

10. Press to display **1-25 Motor Nominal Speed**. Repeat actions 4 and 5 above to set Motor Name Plate Listed RPM.
11. Press to display **3-41 Ramp 1 Ramp Up Time**. Repeat actions 4 and 5 above to set Ramp Up Time (10 Seconds).
12. Press to display **3-42 Ramp 2 Ramp Down Time**. Repeat actions 4 and 5 above to set Ramp Down Time (10 Seconds).
13. Press to display **4-11 Motor Speed Low Limit [RPM]**. Repeat actions 4 and 5 above to set Low Speed Limit (0 RPM).
14. Press to display **4-13 Motor Speed High Limit [RPM]**. Repeat actions 4 and 5 above to set High Speed Limit (Name Plate RPM).
15. Press to display **1-29 Automatic Motor Adaptation**.
16. Press and then to display **[1] Enable Complete AMA**. Follow instruction to complete AMA.
17. Motor and drive are now ready for "Hand on" mode.

STEP 3: Operating in Hand-On Mode

1. Press
2. Press or to modify Motor RPM setting. See Figure 1.
3. Motor and drive are now running in "Hand on" mode.

STEP 4: Formal Startup

Your Pentair Acu Drive is now ready for formal startup. Please complete the Startup Request Information Sheet found in the Acu Drive XS Technical Handbook and Programming Guide (section 1.4). Fax completed form to 845-463-7291. A startup service partner will contact the job site contact person listed and schedule startup.

Programming the Drive to Follow Flowmeter Input



Configuring the Drive to Accept the Analog Input Signal

- Confirm that the flowmeter 4-20mA output is connected to Analog 54 input (Signal coming in from the 4-20mA transmitter)
- Remove the keypad from the Acu Drive™ XS Variable Frequency Drive
- Locate the A54 switch (may be under battery back-up module)
- Move the switch to the right, or where the I is located (I is for current, or 4-20mA signal)
- Reinstall keypad
- Connect flow meter wires to terminals 12 and 54 Red to 12 and black to 54 (flow meter wires are polarity sensitive)



Programming the Display

- Press [Quick Menus] button, then press Q3 [Function Setups], then press Q3-1 [General Settings]
- If you want to change the Display to Display different settings, select the Q3-11 Display Settings, Press OK
- You will see a list of the following “places” that can offer different displays up to 5 simultaneously

Parameter	Recommended display
0-20 Display Line 1.1 Small	1601 – Reference [unit]
0-21 Display Line 1.2 Small	1664 – Analog Input 54
0-22 Display Line 1.3 Small	1617 – Speed [RPM]
0-23 Display Line 2 Large	1652 -- Feedback Unit
0-24 Display Line 3 Large	89 – Date & Time

- You can choose from many different display parameters (a full list of parameters can be found on page 20 of this manual)
- Once done, press the status button and see your new displays on the screen

Additional Checks Before Continuing

- Make sure that 3-14 [preset relative reference] is 0.00%
- Make sure that 3-15 [reference 1 source] is set to [0] No Function
- Make Sure there is no setpoint value in parameters 20-21, 20-22, 20-23
- To reduce chattering when using a flowmeter transmitter, change the averaging on the transmitter from [0] to [100] seconds. See page 34 for details on programming the flowmeter.
- To create a password for the Acu Drive™ XS Variable Frequency Drive, go to parameter 0-6 (Optional)

3.1.0 - Required Programming to Follow Flowmeter

3.1.1 - Programming the Drive to follow the Flowmeter 4-20mA Output Signal

- Press the Quick Menu Button and select Q3 [Function Setups], Press OK
 - Select Q3-3 [Closed Loop Settings], Press OK
 - Select Q3-30 [Feedback Settings], Press OK
 - Press OK on 1-00 [Configuration Mode] to change to parameter [3] Closed Loop, Press OK
 - Down Arrow to Parameter 20-12 Reference/Feedback Unit, Press OK
 - Hit the down arrow to [120] GPM, Press OK
 - Down Arrow past 3-02 because [Minimum Reference] will stay at 0 GPM
 - Down Arrow to Parameter 3-03 [Maximum Reference], Press OK
 - Change to maximum expected flow (this is very important. All preset percentages will be a percentage of this number. Maximum reference is 100% of possible flow, press OK
- Note:** When using 4-20mA flowmeter, maximum span of flowmeter must be the same as the Maximum Reference value in Acu Drive™ XS Variable Frequency Drive. See page 33 for details on programming the flow meter.
- Press the main Menu Button twice, and up arrow to 20-0 [Feedback] Press OK
 - In 20-00 [Feedback 1 Source], Press OK
 - Change to 2 [Analog input 54] Press OK

Additional Checks:

Parameter 6-24 Low Feedback and 6-25 High Feedback – Make sure they match your minimum and maximum references.

3.1.2 - Programming Flowrates in GPM Percentages (References) to Match Time BasedFunctionSettings

- Now go to Main Menu again and select Group 3-** [Reference/Ramps], Press OK
- The 3-0 [Reference limits] is selected, Press OK
- Use the Up or Down Arrow to go to Parameter 3-04 Reference Function, Press OK
- Change to 0 [Sum] , Press OK
- Press Back until Group 3 is in the display
- Press the Down Arrow until 3-1 References, Press OK
- You will see 3-10 Preset Reference [0] 0.00%, Press OK
- Enter your 1st Preset Speed by changing 000.00% Press OK
- Enter your daytime speed (percentage of the maximum reference 3-03) press OK
- While [0] is still highlighted press the up arrow to change the [0] to [1] Press OK and enter Flow percentage for preset reference (1) Then press OK.

Up to 8 preset references can be programmed into the drive from 0 to 100%

<i>Example: Maximum Reference [3-03] = 750 GPM</i>		
Preset Reference #	Reference %	GPM
0	40	300
...	...	...
6	60	450
7	100	750

3.1.3 - Programming the Time Based Functions (i.e. Daytime Operating Hours, Off Hours Operation) :

- Press Main Menu twice
- Press the Up or Down Arrow to 23-** [Time Based Functions], Press OK
- Select 23-0 Timed Actions, Press OK
- Select [Timed Action 1], Press OK
- You will see 23-00 On Time, Press OK
- Enter the daytime speed start time, then press OK
- Press the down button to highlight 23-01 ON Action, Press OK
- Press the Up Arrow until 11 [Select preset ref 0] is selected, then press OK
- Press the Down Arrow to go to 23-02 [OFF Time], press OK
- Enter the daytime speed end time, then Press OK
- Press the Down Arrow to go to 23-03 OFF Action, press OK
- Press the Up Arrow until [11] Preset Reference 1, then Press OK
- Press the back button, then select [Timed Action 2]
- Timed Action 2 will be the Off hours operational speed, or second speed
- Configure Timed Action 2 to start when Timed Action 1 stops, and stop when Timed Action 1 time resumes.
- You will see [23-00 On Time] under [Timed Action 2], Press OK
- Enter the off hour operation start speed, then press OK
- Press the down button to highlight 23-01 ON Action, Press OK
- Press the Up Arrow until 12 [Select preset ref 1] is selected, then press OK
- Press the Down Arrow to go to 23-02 [OFF Time], press OK
- Enter the off hour operation speed end time, then Press OK
- Press the Down Arrow to go to 23-03 OFF Action, press OK
- Press the Up Arrow until 10 [Select preset ref 0], then Press OK
- Continue procedure for any additional time based functions

3.2.0 - Optional Programming Features

3.2.1 - Programming a Set Flowrate Based Off a 24VDC Digital Input (i.e. Signal for Backwash Flowrate)

- Confirm that a connection is made between signaling device and Digital input 32
- On the Acu Drive™ XS Variable Frequency Drive interface, press the main menu button twice and Arrow down to group 5-** [Digital In/Out], Press OK
- Select 5-1*, Press OK
- Down Arrow to 5-14 [Terminal 32 Digital Input] Digital input, Press OK
- Press the back button twice, then up Arrow to Group 3-** [Reference/Ramps], Press OK
- Select 3-1* [References], press OK
- Go to 3-19 Jog Speed [RPM], press OK (This may be 3-11 if Drive is set up to read in hz)
- Input desired set speed. Press OK. This speed will go into effect once signal is sent. Once deactivated, Acu Drive will revert back to its normal operating speed. Input a frequency for the VFD to run when signal is received. For 100% flow enter either the max RPM or Hz of the motor (1800/3600 RPM = xxx GPM = 60Hz), to set at a % set as follows (ex. 50% of flow= 900RPM, GPM=30Hz) Press Ok
- Press the Status Button to view current readings

3.2.2 - Programming the Drive to Run a Second Preset Speed Based Off a 24VDC Digital Input (i.e. Valve Actuation Flowrate)

- Confirm that a connection is made between signaling device and Digital input 33
- On the drive interface, press the main menu button twice and Arrow down to group 5-** [Digital In/Out], Press OK
- Select 5-1*, Press OK
- Down Arrow to 5-15 [Terminal 33 Digital Input] Digital input, Press OK
- Press OK and change to 18 [Preset ref bit 2], Press OK to save
- Press the back button twice, then up Arrow to Group 3-** [Reference/Ramps], Press OK
- Select 3-1* [References], press OK
- Go to 3-10 press OK, scroll to [4] and press OK.
- Insert the desired percentage of full flow. For example enter 50 for 50% of max flowrate.
- Enter this same value in fields [5], [6], and [7]
- Press the Status Button to view current readings

3.3.0 - General Operating Notes

- If ramp up is slow you can bypass the flow meter to a preset rpm by entering parameter 4-60 to set bypass speed.
- If the pump surges you can adjust how it responds to the flow meter in parameters: (20-93 PID Proportional gain default 5 seconds)
(20-94 PID interval time default 20 seconds)

3.4.0 - Hand/On Operation (Running the pump while not in Auto mode)

- To adjust the speed of the pump by the keypad, press the Hand/on button
- Use the left key and Up & Down to move the cursor so set the RPM you desire

Section 4: Programming the Drive to Run at a Fixed Speed

Quick Start Guide

Reset Drive to Factory Settings

To insure that the drive is at factory default before you start programming:

1. Power down drive and wait for all lights to go off.
2. Press and hold: Status, Main Menu and OK.
3. Power up drive, continue holding all 3 buttons for five seconds then release.



ACU DRIVE™ XS Variable Frequency Drive Quick Start Programming and Wiring Guide

Programming the Drive

STEP 1: Setting Location

1. Press twice to display **0-** Operation / Display**
2. Press to display **0-0* Basic Settings**
3. Press
4. Press twice to display **0-03 Regional Settings**
5. Press
6. Press to display **[1] North America**
7. Press

STEP 2: Setting Motor Parameters

1. Press
2. Press to display **Q2 Quick Setup**
3. Press to display **0-01 Language**
4. Press and then or to change setting
5. Press to save desired setting.
6. Press to display **1-21 Motor Power [HP]**. Repeat actions 4 and 5 above to set Motor HP.
7. Press to display **1-22 Motor Voltage**. Repeat actions 4 and 5 above to set Facility Measured Voltage.
8. Press to display **1-23 Motor Frequency**. Repeat actions 4 and 5 above to set Motor Frequency (60Hz).
9. Press to display **1-24 Motor Current**. Repeat actions 4 and 5 above to set Motor Name Plate Amps.

10. Press to display **1-25 Motor Nominal Speed**. Repeat actions 4 and 5 above to set Motor Name Plate Listed RPM.
11. Press to display **3-41 Ramp 1 Ramp Up Time**. Repeat actions 4 and 5 above to set Ramp Up Time (10 Seconds).
12. Press to display **3-42 Ramp 2 Ramp Down Time**. Repeat actions 4 and 5 above to set Ramp Down Time (10 Seconds).
13. Press to display **4-11 Motor Speed Low Limit [RPM]**. Repeat actions 4 and 5 above to set Low Speed Limit (0 RPM).
14. Press to display **4-13 Motor Speed High Limit [RPM]**. Repeat actions 4 and 5 above to set High Speed Limit (Name Plate RPM).
15. Press to display **1-29 Automatic Motor Adaptation**.
16. Press and then to display **[1] Enable Complete AMA**. Follow instruction to complete AMA.
17. Motor and drive are now ready for "Hand on" mode.

STEP 3: Operating in Hand-On Mode

1. Press
2. Press or to modify Motor RPM setting. See Figure 1.
3. Motor and drive are now running in "Hand on" mode.

STEP 4: Formal Startup

Your Pentair Acu Drive is now ready for formal startup. Please complete the Startup Request Information Sheet found in the Acu Drive XS Technical Handbook and Programming Guide (section 1.4). Fax completed form to 845-463-7291. A startup service partner will contact the job site contact person listed and schedule startup.

Programming the Drive to Run at a Fixed Speed

Programming the Display

- Press [Quick Menus] button, then press Q3 [Function Setups], then press Q3-1 [General Settings]
- If you want to change the Display to Display different settings, select the Q3-11 Display Settings, Press OK
- You will see a list of the following “places” that can offer different displays up to 5 simultaneously

Parameter	Recommended display
0-20 Display Line 1.1 Small	1601 – Reference [unit]
0-21 Display Line 1.2 Small	1664 – Analog Input 54
0-22 Display Line 1.3 Small	1617 – Speed [RPM]
0-23 Display Line 2 Large	1609 – Custom [GPM]
0-24 Display Line 3 Large	89 – Date & Time

- You can choose from many different display parameters (a full list of parameters can be found on page 20 of this manual)
- Once done, press the status button and see your new displays on the screen

Additional Checks before Continuing

- Make sure that 3-14 [preset relative reference] is 0.00%
- Make sure that 3-15 [reference 1 source] is set to [0] No Function
- Make Sure there is no setpoint value in parameters 20-21,22,23
- To create a password for the Acu Drive™ XS Variable Frequency Drive, go to parameter 0-6 (Optional)

Programming the Drive to Run at a Fixed Speed Based on Time of Day

Programming Motor Speed Percentages to Match Time Based Functions

- Go to Main Menu again and select Group 3-** [Reference/Ramps], Press OK
- The 3-0 [Reference limits] is selected, Press OK
- Down Arrow to Parameter 3-03 [Maximum Reference], Press OK
- Change to maximum expected flow (this is very important. All preset percentages will be a percentage of this number. Maximum reference is 100% of possible speed, press OK
- Use the Up or Down Arrow to go to Parameter 3-04 Reference Function, Press OK
- Change to 0 [Sum] , Press OK
- Press Back until Group 3 is in the display
- Press the Down Arrow until 3-1 References, Press OK
- You will see 3-10 Preset Reference [0] 0.00%, Press OK
- Enter your 1st Preset Speed by changing [0] Press OK
- Enter your daytime speed (percentage of the maximum reference 3-03) press OK
- While [0] is still highlighted press the up arrow to change to [1]
- Enter your non operational speed [1], which will be a percentage of the maximum reference, then press OK
- Add additional reference points if needed

4.1.2 - Programming the Time Based Functions (i.e. Daytime Operating Hours, Off Hours Operation):

- Press Main Menu twice
- Press the Up or Down Arrow to 23-** [Time Based Functions], Press OK
- Select 23-0 Timed Actions, Press OK
- Select [Timed Action 1], Press OK
- You will see 23-00 On Time, Press OK
- Enter the daytime start speed, then press OK
- Press the down button to highlight 23-01 ON Action, Press OK
- Press the Up Arrow until 10 [Select preset ref 0] is selected, the press OK
- Press the Down Arrow to go to 23-02 [OFF Time], press OK
- Enter the daytime speed end time, then Press OK
- Press the Down Arrow to go to 23-03 OFF Action, press OK
- Press the Up Arrow until 11 [Select preset ref 1], then Press OK
- Press the back button, then select [Timed Action 2]
- Timed Action 2 will be the non-operational speed, or second speed
- Configure Timed Action 2 to start when Timed Action 1 stops, and stop when Timed Action 1 time resumes.
- You will see 23-00 On Time under [Timed Action 2], Press OK
- Enter the non-operation start speed, then press OK
- Press the down button to highlight 23-01 ON Action, Press OK
- Press the Up Arrow until 11 [Select preset ref 1] is selected, the press OK
- Press the Down Arrow to go to 23-02 [OFF Time], press OK
- Enter the non-operation speed end time, then Press OK
- Press the Down Arrow to go to 23-03 OFF Action, press OK
- Press the Up Arrow until 10 [Select preset ref 0], then Press OK
- Continue procedure for any additional time based functions

4.2.0-Optional Programming Features

4.2.1 - Programming a Set Speed Based Off a 24VDC Digital Input

- Confirm that a connection is made between signaling device and Digital input 32
- On the Acu Drive™ XS Variable Frequency Drive interface, press the main menu button twice and Arrow down to group 5-** [Digital In/Out], Press OK
- Select 5-1*, Press OK
- Down Arrow to 5-14 [Terminal 32 Digital Input] Digital input, Press OK
- Press the back button twice, then up Arrow to Group 3-** [Reference/Ramps], Press OK
- Select 3-1* [References], press OK
- Go to 3-19 Jog Speed [RPM], press OK (This may be 3-11 if Drive is set up to read in hz)
- Input desired set speed. Press OK. This speed will go into effect once signal is sent. Once deactivated, Acu Drive will revert back to its normal operating speed. Input a frequency for the VFD to run when signal is received. For 100% flow enter either the max RPM or Hz of the motor(1800/3600 RPM = xxx GPM = 60Hz), to set at a % set as follows (ex. 50% of flow= 900RPM, GPM=30Hz) Press Ok
- Press the Status Button to view current readings

4.2.2 - Programming the Drive to Run a Second Preset Speed Based Off a 24VDC Digital Input (i.e. Backwash Valve Actuation Speed or Heater Dry Contact)

- Confirm that a connection is made between signaling device and Digital input 33
- On the Acu Drive™ XS Variable Frequency Drive interface, press the main menu button twice and Arrow down to group 5-** [Digital In/Out], Press OK
- Select 5-1*, Press OK
- Down Arrow to 5-15 [Terminal 33 Digital Input] Digital input, Press OK
- Press OK and change to 18 [Preset ref bit 2], Press OK to save
- Press the back button twice, then up Arrow to Group 3-** [Reference/Ramps], Press OK
- Select 3-1* [References], press OK
- Go to 3-10 press OK, scroll to [4] and press OK.
- Insert the desired percentage of full speed. For example enter 50 for 50% of max speed.
- Enter this same value in fields [5], [6], and [7]
- Press the Status Button to view current readings

Quick Start Guide

Reset Drive to Factory Settings

To insure that the drive is at factory default before you start programming:

1. Power down drive and wait for all lights to go off.
2. Press and hold: Status, Main Menu and OK.
3. Power up drive, continue holding all 3 buttons for five seconds then release.



ACU DRIVE™ XS Variable Frequency Drive Quick Start Programming and Wiring Guide

Programming the Drive

STEP 1: Setting Location

1. Press twice to display **0-** Operation / Display**
2. Press to display **0-0* Basic Settings**
3. Press
4. Press twice to display **0-03 Regional Settings**
5. Press
6. Press to display **[1] North America**
7. Press

STEP 2: Setting Motor Parameters

1. Press
2. Press to display **Q2 Quick Setup**
3. Press to display **0-01 Language**
4. Press and then or to change setting
5. Press to save desired setting.
6. Press to display **1-21 Motor Power [HP]**. Repeat actions 4 and 5 above to set Motor HP.
7. Press to display **1-22 Motor Voltage**. Repeat actions 4 and 5 above to set Facility Measured Voltage.
8. Press to display **1-23 Motor Frequency**. Repeat actions 4 and 5 above to set Motor Frequency (60Hz).
9. Press to display **1-24 Motor Current**. Repeat actions 4 and 5 above to set Motor Name Plate Amps.

10. Press to display **1-25 Motor Nominal Speed**. Repeat actions 4 and 5 above to set Motor Name Plate Listed RPM.
11. Press to display **3-41 Ramp 1 Ramp Up Time**. Repeat actions 4 and 5 above to set Ramp Up Time (10 Seconds).
12. Press to display **3-42 Ramp 2 Ramp Down Time**. Repeat actions 4 and 5 above to set Ramp Down Time (10 Seconds).
13. Press to display **4-11 Motor Speed Low Limit [RPM]**. Repeat actions 4 and 5 above to set Low Speed Limit (0 RPM).
14. Press to display **4-13 Motor Speed High Limit [RPM]**. Repeat actions 4 and 5 above to set High Speed Limit (Name Plate RPM).
15. Press to display **1-29 Automatic Motor Adaptation**.
16. Press and then to display **[1] Enable Complete AMA**. Follow instruction to complete AMA.
17. Motor and drive are now ready for "Hand on" mode.

STEP 3: Operating in Hand-On Mode

1. Press
2. Press or to modify Motor RPM setting. See Figure 1.
3. Motor and drive are now running in "Hand on" mode.

STEP 4: Formal Startup

Your Pentair Acu Drive is now ready for formal startup. Please complete the Startup Request Information Sheet found in the Acu Drive XS Technical Handbook and Programming Guide (section 1.4). Fax completed form to 845-463-7291. A startup service partner will contact the job site contact person listed and schedule startup.

4.2.3 - Programming the Drive to Run Up to Eight (8) Preset Speeds Based on Binary Combination of Digital Inputs (i.e. Connection With Pool Automation)

- Confirm that a connection is made between signaling device and each of the three digital inputs 29, 32, 33 (refer to Aux 1-3 wiring diagram page 19).
- On the Acu Drive interface, press the main menu button twice and Arrow down to group 5-** [Digital In/Out], Press OK
- Select 5-1*, Press OK
- Down Arrow to 5-10 and verify # 8 [Start], Press OK
- Down Arrow to 5-12 [Terminal 27 Digital Input], Press OK and chg to #15 Preset Ref “ON”
- Down Arrow to 5-13 [Terminal 29 Digital Input], Press OK and chg to #16 Preset Ref. “0”
- Down Arrow to 5-14 [Terminal 32 Digital Input], Press OK and chg to #17 Preset Ref. “1”
- Down Arrow to 5-15 [Terminal 33 Digital Input], Press OK and chg to #18 Preset Reg.“2”
- Press the back button twice, then up Arrow to Group 3-** [Reference/Ramps], Press OK
- Select 3-1* [References], press OK
- Establish desired preset reference speeds. Go to 3-10 press OK scroll and set each similar to

Additional Checks before Continuing

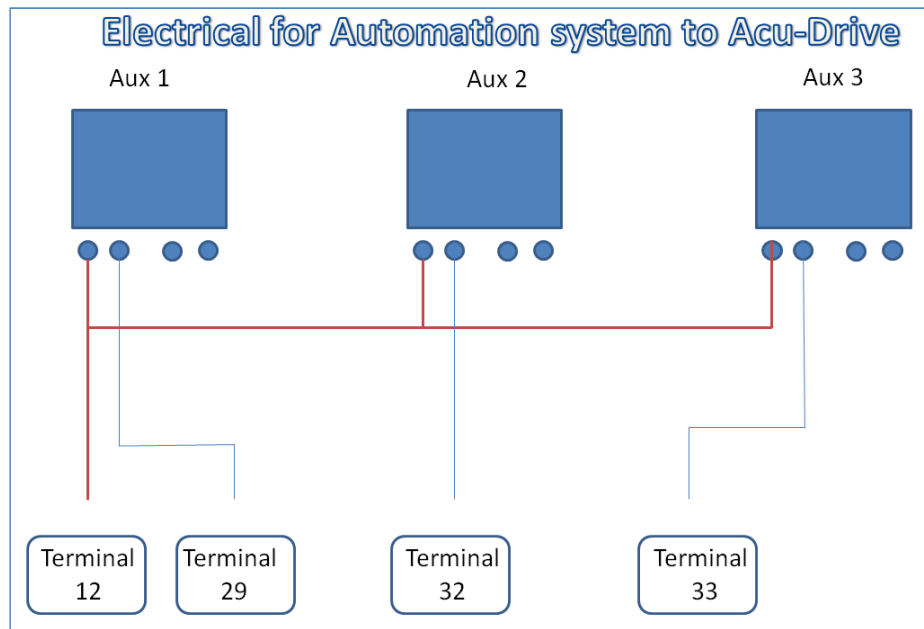
- Make Sure there is no setpoint value in parameters 20-21,22,23
- To create a password for the Acu Drive™ XS Variable Frequency Drive, go to parameter 0-6 (Optional)

Sample table .

<i>Example: Maximum Reference [3-03] = 1300 GPM</i>		
Preset Reference #	Reference %	GPM
0	0	0
1	30	390
2	45	585
3	50	650
4	60	780
5	70	910
6	90	1170
7	100	1300

4.2.4 - Wire Diagram for Automation System Relays

- Refer to below table for wiring and activating appropriate input for desired preset reference speed selection on the Acu Drive™ XS Variable Frequency Drive.



4.3.0 - General Operating Notes

4.3.1 - Hand/On Operation (Running the pump while not in Auto mode)

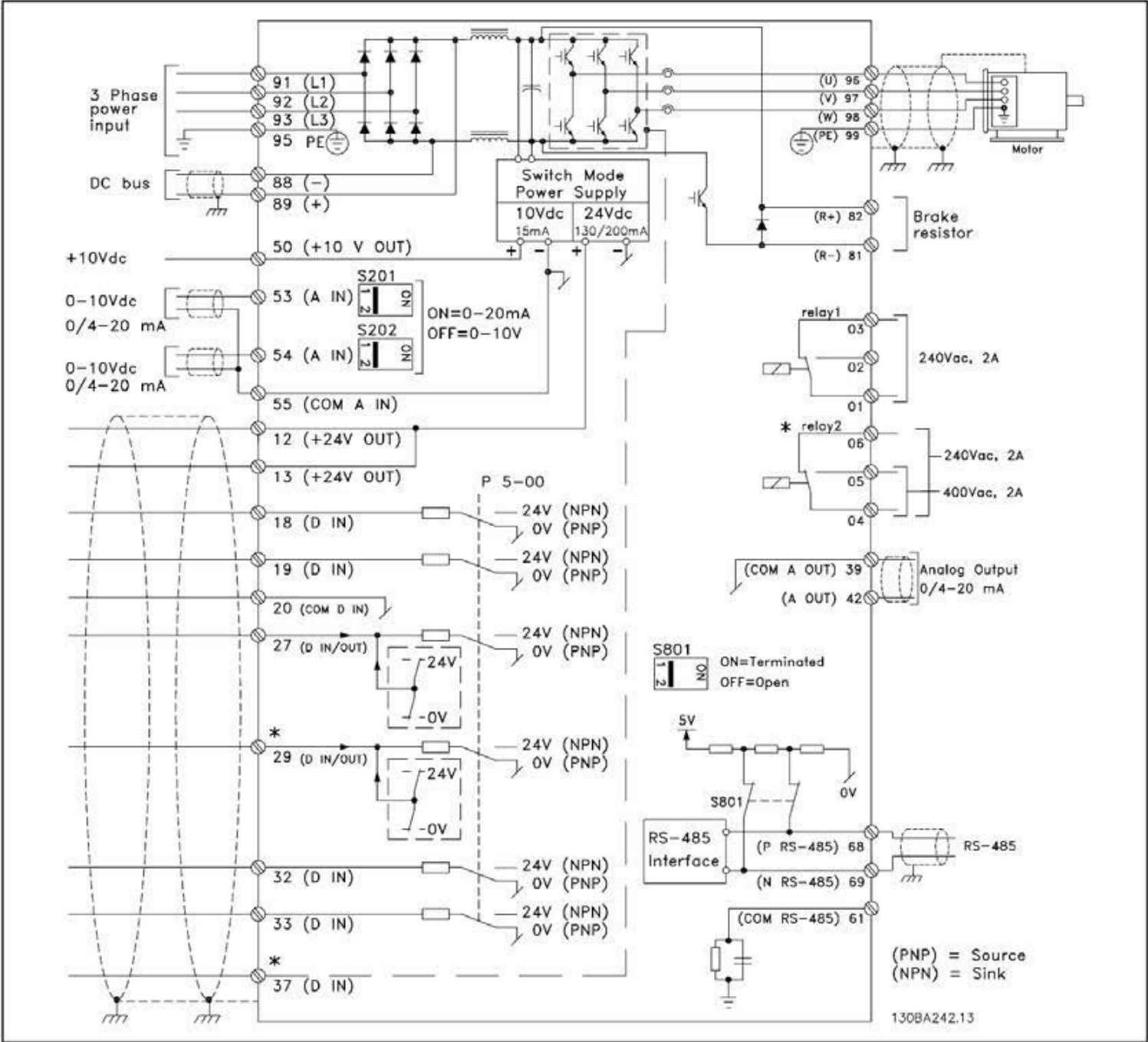
- To adjust the speed of the pump by the keypad, press the Hand/on button
Use the left key and Up & Down to move the cursor so set the RPM you desire
- If you press Off, the unit will stop
- When left in Hand/on, the time Clock function will not turn the Pump on/off at the programmed times.

Section 8: Wire Diagrams

8.1.0 - Acu Drive™ XS Variable Frequency Drive Connections

Connection Example

This diagram shows the typical installation of the drive. The numbers represent the terminals on the drive.





1620 HAWKINS AVE., SANFORD, NC 27330 • (919) 566-8000
10951 WEST LOS ANGELES AVE., MOORPARK, CA 93021 • (805) 553-5000

WWW.PENTAIRCOMMERCIAL.COM

All Pentair trademarks and logos are owned by Pentair or one of its global affiliates. Pentair Commercial Aquatics™ and Acu Drive™ are trademarks and/or registered trademarks of Pentair Water Pool and Spa, Inc. and/or its affiliated companies in the United States and/ or other countries. Unless expressly noted, names and brands of third parties that may be used in this document are not used to indicate an affiliation or endorsement between the owners of these names and brands and Pentair Water Pool and Spa, Inc. Those names and brands may be the trademarks or registered trademarks of those third parties. Because we are continuously improving our products and services, Pentair reserves the right to change specifications without prior notice. Pentair is an equal opportunity employer.

© 2015 Pentair Water Pool and Spa, Inc. All rights reserved. This document is subject to change without notice.

P/N AD-TECHHB REV. B 11/16/15