



SMVector - Frequency Inverter Operating Instructions

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About These Instructions

This documentation applies to the SMV frequency inverter and contains important technical data regarding the installation, operation, and commissioning of the inverter.

These instructions are only valid for SMV frequency inverters with software revision 4.23 or higher

For version 4.23 software, the drive nameplate illustrated below would show "42" in the "F" location.

Please read these instructions in their entirety before commissioning the drive.



Α	В	С	D	E	F
Certifications	Туре	Input Ratings	Output Ratings	Hardware Version	Software Version

Scope of delivery	Important
 1 SMV Inverter with EPM installed (see Section 4.4) 1 Operating Instructions manual 	After receipt of the delivery, check immediately whether the items delivered match the accompanying papers. Lenze AC Tech does not accept any liability for deficiencies claimed subsequently. Claim: • visible transport damage immediately to the forwarder. • visible deficiencies /incompleteness immediately to your Lenze AC Tech representative

Related Documents

The documentation listed herein contains information relevant to the operation of the SMVector frequency inverter. To obtain the latest documentation, visit the Technical Library at Lenze website.

Document #	Description
CMVINS01	SMVector Communications Module Installation Instruction
CMVMB401	SMVector ModBus RTU over RS485 Communications Reference Guide
CMVLC401	SMVector Lecom Communications Reference Guide
CMVCAN01	SMVector CANopen Communications Reference Guide
CMVDVN01	SMVector DeviceNet Communications Reference Guide
CMVETH01	SMVector EtherNet/IP Communications Reference Guide
CMVPFB01	SMVector PROFIBUS Communications Reference Guide
ALSV01	SMVector Additional I/O Module Installation and Operation Manual
DBV01	SMVector Dynamic Braking
PTV01	SMVector Potentiometer Install Instructions
RKV01	SMVector ESVZXK1 Remote Keypad
RKVU01	SMVector ESVZXH0 Remote Keypad (for NEMA 1 15-60HP (11-45kW) Drives)

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All information given in this documentation has been carefully selected and tested for compliance with the hardware and software described. Nevertheless, discrepancies cannot be ruled out. Lenze AC Tech does not accept any responsibility nor liability for damages that may occur. Any necessary corrections will be implemented in subsequent editions. This document is printed in the United States

Safety Information

1 Safety Information

General

Some parts of Lenze AC Tech controllers can be electrically live and some surfaces can be hot. Non-authorized removal of the required cover, inappropriate use, and incorrect installation or operation creates the risk of severe injury to personnel and/or damage to equipment.

All operations concerning transport, installation, and commissioning as well as maintenance must be carried out by qualified, skilled personnel who are familiar with the installation, assembly, commissioning, and operation of variable frequency drives and the application for which it is being used.

Installation

Ensure proper handling and avoid excessive mechanical stress. Do not bend any components and do not change any insulation distances during transport, handling, installation or maintenance. Do not touch any electronic components or contacts. This drive contains electrostatically sensitive components, which can easily be damaged by inappropriate handling. Static control precautions must be adhered to during installation, testing, servicing and repairing of this drive and associated options. Component damage may result if proper procedures are not followed.

To ensure proper operation, do not install the drive where it is subjected to adverse environmental conditions such as combustible, oily, or hazardous vapors; corrosive chemicals; excessive dust, moisture or vibration; direct sunlight or extreme temperatures.

This drive has been tested by Underwriters Laboratory (UL) and is UL Listed in compliance with the UL508C Safety Standard. This drive must be installed and configured in accordance with both national and international standards. Local codes and regulations take precedence over recommendations provided in this and other Lenze AC Tech documentation.

The SMVector drive is considered a component for integration into a machine or process. It is neither a machine nor a device ready for use in accordance with European directives (reference machinery directive and electromagnetic compatibility directive). It is the responsibility of the end user to ensure that the machine meets the applicable standards.

Electrical Connection

When working on live drive controllers, applicable national safety regulations must be observed. The electrical installation must be carried out according to the appropriate regulations (e.g. cable cross-sections, fuses, protective earth [PE] connection). While this document does make recommendations in regards to these items, national and local codes must be adhered to.

The documentation contains information about installation in compliance with EMC (shielding, grounding, filters and cables). These notes must also be observed for CE-marked controllers. The manufacturer of the system or machine is responsible for compliance with the required limit values demanded by EMC legislation.

Application

The drive must not be used as a safety device for machines where there is a risk of personal injury or material damage. Emergency Stops, over-speed protection, acceleration and deceleration limits, etc must be made by other devices to ensure operation under all conditions.

The drive does feature many protection devices that work to protect the drive and the driven equipment by generating a fault and shutting the drive and motor down. Mains power variances can also result in shutdown of the drive. When the fault condition disappears or is cleared, the drive can be configured to automatically restart, it is the responsibility of the user, OEM and/or integrator to ensure that the drive is configured for safe operation.



Safety Information

Explosion Proof Applications

Explosion proof motors that are not rated for inverter use lose their certification when used for variable speed. Due to the many areas of liability that may be encountered when dealing with these applications, the following statement of policy applies:

Lenze AC Tech Corporation inverter products are sold with no warranty of fitness for a particular purpose or warranty of suitability for use with explosion proof motors. Lenze AC Tech Corporation accepts no responsibility for any direct, incidental or consequential loss, cost or damage that may arise through the use of AC inverter products in these applications. The purchaser expressly agrees to assume all risk of any loss, cost or damage that may arise from such application.

Operation

Systems including controllers must be equipped with additional monitoring and protection devices according to the corresponding standards (e.g. technical equipment, regulations for prevention of accidents, etc.). The controller may be adapted to your application as described in this documentation.



DANGER!

- After the controller has been disconnected from the supply voltage, live components and power connection
 must not be touched immediately, since capacitors could be charged. Please observe the corresponding notes
 on the controller.
- · Close all protective covers and doors prior to and during operation.
- Do not cycle input power to the controller more than once every two minutes.
- For SMVector models that are equipped with a Disconnect Switch (11th character in model number is L or M), the Disconnect Switch is intended as a motor service disconnect and does not provide branch circuit protection to the inverter or motor. When servicing the motor, it is necessary to wait 3 minutes after turning this switch to the off position before working on motor power wiring as the inverter stores electrical power. To service the inverter, it is necessary to remove mains ahead of the drive and wait 3 minutes.

Safety Notifications

All safety information given in these Operating Instructions includes a visual icon, a bold signal word and a description.



Signal Word! (characterizes the severity of the danger)

NOTE (describes the danger and informs on how to proceed)

lcon	Signal Word	Meaning	Consequences if ignored
Â	DANGER!	Warns of hazardous electrical voltage.	Death or severe injuries.
\triangle	WARNING!	Warns of potential, very hazardous situations.	Risk of severe injury to personnel and/or damage to equipment.
	WARNING! Hot Surface	Warns of hot surface and risk of burns. Labels may be on or inside the equipment to alert people that surfaces may reach dangerous temperatures.	Risk of severe injury to personnel.
STOP	STOP!	Warns of potential damage to material and equipment.	Damage to the controller/drive or its environment.
i	NOTE	Designates a general, useful note.	None. If observed, then using the controller/ drive system is made easier.

Safety Information



Harmonics Notification in accordance with EN 61000-3-2, EN 61000-3-12:

Operation in public supply networks (Limitation of harmonic currents i.a.w. EN 61000-3-2, Electromagnetic Compatibility (EMC) Limits). Limits for harmonic current emissions (equipment input current up to 16A/phase).

Directive	Total Power connected to Mains (public supply)	Additional Measures Required for Compliance ⁽²⁾
	< 0.5kW	with mains choke
EN 61000-3-2	0.5 1kW	with active filter
	> 1kW	complies without additional measures
EN 61000-3-12	16 75amp	Additional measures are required for compliance with the standard

(1) For compliance with EMC regulations, the permissable cable lengths may change.

(2) The additional measures described only ensure that the controller meets the requirements of the EN 61000-3-2. The machine/system manufacturer is responsible for the machine's compliance with the regulations.

Safety Information in accordance with EN 61800-5-1:



DANGER! Hazard of Electrical Shock

Capacitors retain charge for approximately 180 seconds after power is removed. Allow at least 3 minutes for discharge of residual charge before touching the drive.

WARNING!

- This product can cause a d.c. current in the PE conductor. Where a residual current-operated (RCD) or monitoring (RCM) device is used for protection in case of direct or indirect contact, only an RCD or RCM Type B is allowed on the supply side of this product.
- Leakage Current may exceed 3.5mA AC. The minimum size of the PE conductor shall comply with local safety regulations for high leakage current equipment.
- In a domestic environment, this product may cause radio interference in which case supplementary mitigation measures may be required.



NOTE

Control and communications terminals provide reinforced insulation (i.e. considered SELV or PELV, providing protection in case of direct contact) when the drive is connected to a power system rated up to 300VAC between phase to ground (PE) and the applied voltage on Terminals 16 and 17 is less than 150VAC between phase to ground. Otherwise, control and communications terminals provide basic insulation.

Safety Information in accordance with UL:

Note for UL approved system with integrated controllers: UL warnings are notes which apply to UL systems. The documentation contains special information about UL.



Suitable for use on a circuit capable of delivering not more than 200,000 rms symmetrical amperes, at



- the maximum voltage rating marked on the drive.
- · Use minimum 75 °C copper wire only.
- · Shall be installed in a pollution degree 2 macro-environment.
- NEMA 1 (IP31) models shall be installed in a pollution degree 2 macro-environment.
- All models are suitable for installation in a compartment handling Conditioned Air (i.e., plenum rated).

Torque Requirements (in accordance with UL) are listed in section 3.2.1, Power Connections.



2 Technical Data

2.1 Standards and Application Conditions

Conformity	CE	Low Voltage (2006/95/EC) & EMC (2004/108/EC) Directives			
Approvals	UL508C	Underwriters Laboratories -Power Conversion Equipment			
Input voltage phase imbalance	≤ 2%				
Supported Power Systems	TT TN	 For central grounded systems, operation is permitted without restrictions. For corner grounded 400/500V systems, operation is possible but reinforced insulation to control circuits is compromised. 			
Humidity	\leq 95% non-condens	sing			
	Transport	-25 +70°C			
Temperature range	Storage	-20 +70°C			
	Operation	-10 \dots +55°C (with 2.5%/°C current derating above +40°C)			
Installation height	0 - 4000m a.m.s.l.	(with 5%/1000 m current derating above 1000m a.m.s.l.)			
Vibration resistance	acceleration resistant up to 1.0g				
🕂 Earth leakage current	> 3.5 mA to PE				
Max Pormissable Cable Longth (1)	<= 4.0 Hp (3.0 kW)	30 meters shielded, 60 meters un-shielded			
Max Fernissable Gable Length	=> 5.0 Hp (3.7 kW)	50 meters shielded, 100 meters un-shielded.			
	IP31/NEMA 1	IP65/NEMA 4X			
Enclosure	NEMA 1 and NEMA 508C and are suitab	4X model enclosures are plenun rated in accordance with UL le for installation in a compartment handling conditioned air.			
Protection measures against	short circuit, earth fa motor stalling, over	ault, phase loss, over voltage, under voltage, temperature, motor overload			
	< 0.5kW	with mains choke			
Compliance with EN 61000-3-2 Requirements ⁽²⁾	0.5 1kW	with active filter			
• • •	> 1kW	without additional measures			
Compliance with EN 61000-3-12 Requirements ⁽²⁾	16 75amp	Additional measures required for compliance with EN 61000-3-12			

Operation in public supply networks (Limitation of harmonic currents i.a.w. EN 61000-3-2, Electromagnetic Compatibility (EMC) Limits). Limits for harmonic current emissions (equipment input current up to 16A/phase).

(1) The stated cable lengths are permissible at default carrier frequencies (refer to parameter P166).

(2) The additional measures described only ensure that the controller meets the requirements of the EN 61000-3-2. The machine/system manufacturer is responsible for the machine's compliance with the regulations.





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2.2 **SMV Type Number Designation**

i

The table herein describes the Type numbering designation for the SMVector Inverter models.

	ESV	152	NO	2	т	Х	В
Electrical Products in the SMVector Series							
Power Rating in kW:							
251 = 0.25kW (0.33HP)	113 = 11.0kW (15HP)						
371 = 0.37kW (0.5HP)	153 = 15.0	(20HP)					
751 = 0.75kW (1HP)	183 = 18.5	(W (25HP)					
112 = 1.1kW (1.5HP)	223 = 22.0	(30HP)					
152 = 1.5kW (2HP)	303 = 30.0	(40HP)					
222 = 2.2kW (3HP)	373 = 37.5	(W (50HP)					
302 = 3.0kW (4HP)	453 = 45.0	(W (60HP)					
402 = 4.0kW (5HP)							
552 = 5.5kW (7.5HP)							
752 = 7.5kW (10HP)							
Installed I/O & Communication Module(s):							
C_ = CANopen (Available all models)	The "_" bla	nk can be:					
D_ = DeviceNet (Available all models)	0 = Standar	d Keypad					
E_ = Ethernet/IP, (Available all models)							
R_ = RS-485 / ModBus /Lecom (Avail all models)							
P_ = ProfiBus-DP (Available all models)							
N_ = No Communications installed							
Input Voltage:							
1 = 120 VAC (doubler output) or 240 VAC							
2 = 240 VAC							
4 = 400/480 VAC							
6 = 600 VAC							
Input Phase:							
S = Single Phase Input only							
Y = Single or Three Phase Input							
T = Three Phase Input only							
Input Line Filter							
F = Integral EMC Filter							
L = Integral EMC Filter and Integrated Disconnect	Switch (NEMA 4)	VIP65 Models	only)				
M = Integrated Disconnect Switch (NEMA 4X/IP65	Models only)						
X = No EMC Filter/ No Disconnect Switch							
Enclosure:							
B = NEMA 1/IP31; Indoor only							
C = NEMA 4X/IP65; Indoor only; Convection cooled							
D = NEMA 4X/IP65; Indoor only; Fan cooled							
E = NEMA 4X/IP65; Indoor/Outdoor; Convection co	bled						
F = NEMA 4X/IP65; Indoor/Outdoor; Fan cooled							
NOTE							_

Prior to installation make sure the enclosure is suitable for the end-use environment Variables that influence enclosure suitability include (but are not limited to) temperature, airborne contaminates, chemical concentration, mechanical stress and duration of exposure (sunlight, wind, precipitation).



2.3 Ratings

120V / 240VAC Models

Mains = 120V Single Phase (1/N/PE) (90132V), 240V Single Phase (2/PE) (170264V); 4862Hz											
Туре	Po	wer	Mains Current		Output Current		Heat Loss (Watts)				
	Hp	kW	120V A	240V A	Cont (I _n) A	Max I %	N1/IP31	N4X/IP65 No filter	N4X/IP65 W/ filter		
ESV2511S	0.33	0.25	6.8	3.4	1.7	200	24				
ESV3711S	0.5	0.37	9.2	4.6	2.4	200	32	32			
ESV7511S	1	0.75	16.6	8.3	4.2	200	52	41			
ESV1121S	1.5	1.1	20	10.0	6.0	200	74	74			

NOTES:

Output Current: The Output Current Maximum (%) is a percentage of the Output Current Continuous Amps (In) rating and is adjustable in parameter P171.

240VAC Models

Mains = 240V Single Phase (2/PE) (170264V); 4862Hz												
Туре	Po	wer	Mains Current	Output Current		Heat Loss (Watts)						
Hp kW		240V A	Cont (I _n) A	Max I %	N1/IP31	N4X/IP65 No filter	N4X/IP65 W/ filter					
ESV2512S	0.33	0.25	3.4	1.7	200	20						
ESV3712S	0.5 0.37		5.1	2.4	200			30				
ESV7512S	1 0.75		8.8	4.2	200			42				
ESV1122S	1.5	1.1	12.0	6.0	200			63				
ESV1522S	2 1.5		13.3	7.0	200			73				
ESV2222S	22225 3 2.2		17.1	9.6	200			97				

240V Single Phase (2/PE) (170264V), 240V Three Phase (3/PE) (170264V); 4862Hz											
Туре	Po	wer	Mains Current		Output Current		Heat Loss (Watts)				
	Hp	kW	1~ (2/PE) A	3~ (3/PE) A	Cont (I _n) A	Max I %	N1/IP31	N4X/IP65 No filter	N4X/IP65 W/ filter		
ESV3712Y	0.5	0.37	5.1	2.9	2.4	200	27	26			
ESV7512Y	1	0.75	8.8	5.0	4.2	200	41	38			
ESV1122Y	1.5	1.1	12.0	6.9	6.0	200	64	59			
ESV1522Y	2	1.5	13.3	8.1	7.0	200	75	69			
ESV2222Y	3	2.2	17.1	10.8	9.6	200	103	93			



240V Three Phase (3/PE) (170264V); 4862Hz												
Туре	Power		Mains Current	Mains Current Output Current		Heat Loss (Watts)						
	Нр	kW	240V A	Cont (I _n) A	Max I %	N1/IP31	N4X/IP65 No filter	N4X/IP65 W/ filter				
ESV1122T	1.5	1.1	6.9	6	200	64						
ESV1522T	2	1.5	8.1	7	200	75						
ESV2222T	3	2.2	10.8	9.6	200	103						
ESV4022T	5	4.0	18.6	16.5	200	154	139					
ESV5522T	7.5	5.5	26	23	200	225	167					
ESV7522T	10	7.5	33	29	200	274	242					
ESV1132T	15	11	48	42	180	485	468					
ESV1532T	20	15	59	54	180	614	591					

NOTES:

Output Current: The Output Current Maximum (%) is a percentage of the Output Current Continuous Amps (In) rating and is adjustable in parameter P171.

400...480VAC Models

400 4	400 480V Three Phase (3/PE) (400V: 340440V), (480V: 340528V); 4862Hz											
Туре	Po	wer	Mains	Current	0	utput	Curre	ent	He	Heat Loss (Watts)		
	Hp	kW	400V A	480V A	Con	t (I _n) A	Ma	ax I 6	N1/IP31	N4X/IP65 No filter	N4X/IP65 W/ filter	
					400V	480V	400V	480V				
ESV3714T	0.5	0.37	1.7	1.5	1.3	1.1	175	200	23	21	25	
ESV7514T	1	0.75	2.9	2.5	2.4	2.1	175	200	37	33	37	
ESV1124T	1.5	1.1	4.2	3.6	3.5	3.0	175	200	48	42	46	
ESV1524T	2	1.5	4.7	4.1	4.0	3.5	175	200	57	50	54	
ESV2224T	3	2.2	6.1	5.4	5.5	4.8	175	200	87	78	82	
ESV3024T	4	3.0	8.3	7.0	7.6	6.3	175	200			95	
ESV4024T	5	4.0	10.6	9.3	9.4	8.2	175	200	128	103	111	
ESV5524T	7.5	5.5	14.2	12.4	12.6	11.0	175	200	178	157	165	
ESV7524T	10	7.5	18.1	15.8	16.1	14.0	175	200	208	190	198	
ESV1134T	15	11	27	24	24	21	155	180	418	388	398	
ESV1534T	20	15	35	31	31	27	155	180	493	449	459	
ESV1834T	25	18.5	44	38	39	34	155	180	645	589	600	
ESV2234T	30	22	52	45	46	40	155	180	709	637	647	
ESV3034T	40	30	68	59	60	52	155	180	1020			
ESV3734T	50	37.5	85	74	75	65	155	180	1275			
ESV4534T	60	45	100	87	88	77	155	180	1530			

NOTES:

Output Current: The Output Current Maximum (%) is a percentage of the Output Current Continuous Amps (In) rating and is adjustable in parameter P171.

For 400...480 VAC models, the output current maximum (%) in the 400V column is used when P107 = 0For 400...480 VAC models, the output current maximum (%) in the 480V column is used when P107 = 1



	600V Three Phase (3/PE) (425660V); 4862Hz										
Туре	Po	wer	Mains Current	Outpu	t Current	He	at Loss (Wa	atts)			
	Hp	kW	А	Cont (I _n) A	Max I %	N1/IP31	N4X/IP65 No filter	N4X/IP65 W/ filter			
ESV7516T	1	0.75	2	1.7	200	37	31				
ESV1526T	2	1.5	3.2	2.7	200	51	43				
ESV2226T	3	2.2	4.4	3.9	200	68	57				
ESV4026T	5	4	6.8	6.1	200	101	67				
ESV5526T	7.5	5.5	10.2	9	200	148	116				
ESV7526T	10	7.5	12.4	11	200	172	152				
ESV1136T	15	11	19.7	17	180	380	356				
ESV1536T	20	15	25	22	180	463	431				
ESV1836T	25	18.5	31	27	180	560	519				
ESV2236T	30	22	36	32	180	640	592				
ESV3036T	40	30	47	41	180	930					
ESV3736T	50	37.5	59	52	180	1163					
ESV4536T	60	45	71	62	180	1395					

600VAC Models

NOTES:

Output Current: The Output Current Maximum (%) is a percentage of the Output Current Continuous Amps (In) rating and is adjustable in parameter P171.



STOP!

- For installations above 1000m a.m.s.l., derate I_n by 5% per 1000m, do not exceed 4000m a.m.s.l.
- Operation above 40°C, derate I_n by 2.5% per °C, do not exceed 55°C.

Output Current (In) derating for Carrier Frequency (P166) for NEMA 1 (IP31) Models:

- If P166=2 (8 kHz), derate In to 92% of drive rating
- If P166=3 (10 kHz), derate In to 84% of drive rating

Output Current (In) derating for Carrier Frequency (P166) for NEMA 4X (IP65) Models:

- If P166=1 (6 kHz), derate In to 92% of drive rating
- If P166=2 (8 kHz), derate In to 84% of drive rating
- If P166=3 (10 kHz), derate In to 76% of drive rating

3 Installation

3.1 Dimensions and Mounting

WARNING!

Æ

Drives must not be installed where subjected to adverse environmental conditions such as: combustible, oily, or hazardous vapors; corrosive chemicals; excessive dust, moisture or vibration; direct sunlight or extreme temperatures.

3.1.1 NEMA 1 (IP31) Models ≤ 30HP (22kW)







	Туре	a in (mm)	a1 in (mm)	b in (mm)	b1 in (mm)	b2 in (mm)	c in (mm)	s1 in (mm)	s2 in (mm)	m Ib (kg)
G1	ESV251~~~~B; ESV371~~~~B ESV751~~~~B	3.90 (99)	3.12 (79)	7.48 (190)	7.00 (178)	0.24 (6)	4.35 (111)	0.6 (15)	2.0 (50)	2.0 (0.9)
G2	ESV112~~~~B; ESV152~~~~B ESV222~~~~B	3.90 (99)	3.12 (79)	7.52 (191)	7.00 (178)	0.26 (7)	5.45 (138)	0.6 (15)	2.0 (50)	2.8 (1.3)
G3	ESV402~~~~B	3.90 (99)	3.12 (79)	7.52 (191)	7.00 (178)	0.30 (8)	5.80 (147)	0.6 (15)	2.0 (50)	3.2 (1.5)
H1	ESV552~~~~B; ESV752~~~~B	5.12 (130)	4.25 (108)	9.83 (250)	9.30 (236)	0.26 (7)	6.30 (160)	0.6 (15)	2.0 (50)	6.0 (2.0)
J1	ESV113~~~~B; ESV153~~~~B ESV183~~~~B; ESV223~~~~B	6.92 (176)	5.75 (146)	12.50 (318)	11.88 (302)	0.31 (8)	8.09 (205)	0.6 (15)	2.0 (50)	13.55 (6.15)

Conduit Hole Dimensions	Туре	N in (mm)	P in (mm)	P1 in (mm)	Q in (mm)	S in (mm)
	G1	1.84 (47)	1.93 (49)	.70 (18)	1.00 (25)	.88 (22)
	G2	1.84 (47)	3.03 (77)	.70 (18)	1.00 (25)	.88 (22)
	G3	1.84 (47)	3.38 (86)	.70 (18)	1.00 (25)	.88 (22)
	H1	2 46 (62)	3 55 (90)	13 (3)	1 38 (35)	1.13 (29)
		2.40 (02)	0.00 (00)	.10 (0)	1.00 (00)	.88 (22)
	н	2.22 (0.4)	4 00 (117)	72 (10)	1 40 (20)	1.31 (33)
- N -	JI	3.32 (64)	4.02 (117)	.73(19)	1.40 (36)	.88 (22)

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	Туре	a in (mm)	a1 in (mm)	b in (mm)	b1 in (mm)	b2 in (mm)	c in (mm)	s1 in (mm)	s2 in (mm)	m lb (kg)
K1	ESV303~~4~~B; ESV303~~6~~B	8.72 (221)	7.50 (190)	14.19 (360)	13.30 (338)	0.45 (11.4)	10.07 (256)	0.6 (15)	2.0 (50)	24 (10.9)
К2	ESV373~~4~~B; ESV373~~6~~B	8.72 (221)	7.50 (190)	17.19 (436)	16.30 (414)	0.45 (11.4)	10.07 (256)	0.6 (15)	2.0 (50)	31 (14.1)
КЗ	ESV453~~4~~B ESV453~~6~~b	8.72 (221)	7.50 (190)	20.19 (513)	19.30 (490)	0.45 (11.4)	10.07 (256)	0.6 (15)	2.0 (50)	35 (15.9)

Conduit Hole Dimensions	Туре	N in (mm)	P in (mm)	P1	Q in (mm)	S	S1
	K1	3.75 (95)	5.42 (137)	1.50 (38.1)	1.75 (44.4)	1.75 (44.4)	0.875 (22.2)
	K2	3.75 (95)	5.42 (137)	1.50 (38.1)	1.75 (44.4)	1.75 (44.4)	0.875 (22.2)
	K3	3.75 (95)	5.42 (137)	1.50 (38.1)	1.75 (44.4)	1.75 (44.4)	0.875 (22.2)





3.1.3 NEMA 4X (IP65) Models







	Туре	a in (mm)	a1 in (mm)	b in (mm)	b1 in (mm)	b2 in (mm)	c in (mm)	s1 in (mm)	s2 in (mm)	m lb (kg)
R1	ESV371N01SX_; ESV751N01SX_; ESV371N02YX_; ESV751N02YX_; ESV371N04TX_; ESV751N04TX_; ESV751N06TX_; ESV751N04TS_; ESV751N02SF_; ESV371N04TF_; ESV751N04TF_;	6.28 (160)	5.90 (150)	8.00 (203)	6.56 (167)	0.66 (17)	4.47 (114)	2.00 (51)	2.00 (51)	3.6 (1.63)
R2	ESV112N01SX_; ESV112N02YX_; ESV152N02YX_; ESV12N04TX_; ESV152N04TX_; ESV22N04TX_; ESV152N06TX_; ESV222N06TX_; ESV112N02SF_; ESV152N02SF_; ESV112N04TF_; ESV152N04TF_; ESV222N04TF_; ESV302N04TF_;	6.28 (160)	5.90 (150)	8.00 (203)	6.56 (167)	0.66 (17)	6.31 (160)	2.00 (51)	2.00 (51)	5.9 (2.68)
S1	ESV222N02YX_; ESV222N02SF_	7.12 (181)	6.74 (171)	8.00 (203)	6.56 (167)	0.66 (17)	6.77 (172)	2.00 (51)	2.00 (51)	7.1 (3.24)
T1	ESV552N02TX~; ESV752N02TX~ ESV752N04TX~; ESV752N06TX~; ESV752N04TF~	8.04 (204)	7.56 (192)	10.00 (254)	8.04 (204)	0.92 (23)	8.00 (203)	4.00 (102)	4.00 (102)	10.98 (4.98)
V1	ESV402N02TX_; ESV402N04TX_; ESV552N04TX_; ESV402N06TX_ ESV552N06TX_; ESV402N04TF_; ESV552N06TX_; ESV402N04TF_;	8.96 (228)	8.48 (215)	10.00 (254)	8.04 (204)	0.92 (23)	8.00 (203)	4.00 (102)	4.00 (102)	11.58 (5.25)
W1	ESV113N02TX; ESV153N02TX ESV113N04TX; ESV153N04TX ESV113N04TF; ESV153N04TF ESV113N04TF; ESV153N06TX ESV183N04TX; ESV183N04TF ESV183N06TX;	9.42 (240)	8.94 (228)	14.50 (368)	12.54 (319)	0.92 (24)	9.45 (241)	4.00 (102)	4.00 (102)	22.0 (10.0)
X1	ESV223N04TX~; ESV223N04TF~ ESV223N06TX~	9.42 (240)	8.94 (228)	18.5 (470)	16.54 (420)	0.92 (24)	9.45 (241)	4.00 (102)	4.00 (102)	25.5 (11.6)

_ = Last digit of part number:

$$\begin{split} C &= N4X \text{ Indoor (convection cooled)} \\ E &= N4X \text{ In/Outdoor (convection cooled)} \end{split}$$

 \sim = Last digit of part number: D = N4X Indoor (fan cooled) F = N4X In/Outdoor (fan cooled)

Conduit Hole	Dimensions	Туре	N in (mm)	P in (mm)	Q in (mm)	S in (mm)	S1 in (mm)
0 0	H=0-4-0-4	R1	3.14 (80)	2.33 (59)	1.50 (38)	.88 (22)	n/a
		R2	3.14 (80)	4.18 (106)	1.50 (38)	.88 (22)	n/a
-++++++++++++++++++++++++++++++++++++++		S1	3.56 (90)	4.63 (118)	1.50 (38)	.88 (22)	n/a
		T1	4.02 (102)	5.00 (127)	1.85 (47)	1.06 (27)	n/a
P		V1	4.48 (114)	5.00 (127)	1.85 (47)	1.06 (27)	n/a
		W1	4.71 (120)	5.70 (145)	2.00 (51)	1.375 (35)	1.125 (28)
- n -	₩	X1	4.71 (120)	5.70 (145)	2.00 (51)	1.375 (35)	1.125 (28)

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3.1.4 NEMA 4X (IP65) Models with Disconnect Switch







		а	a1	b	b1	b2	c	c1	s1	s2	m
	Туре	in	in	in	in	in	in	in	in	in	lb
		(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(kg)
AA1	ESV371N01SM_; ESV371N02YM_; ESV371N02SL_; ESV371N04TM_; ESV371N04TL_; ESV371N06TM_; ESV751N01SM_; ESV751N02YM_; ESV751N02SL_; ESV751N04TM_; ESV751N04TL_; ESV751N06TM_;	6.28 (160)	5.90 (150)	10.99 (279)	9.54 (242)	0.66 (17)	4.47 (114)	.86 (22)	2.00 (51)	2.00 (51)	4.7 (2.13)
AA2	ESV112N01SM_; ESV112N02YM_; ESV112N02SL_; ESV12N04TM_; ESV12N02SL_; ESV12N04TM_; ESV152N02SL_; ESV152N04TM_; ESV152N04TL_; ESV152N04TM_; ESV222N04TM_; ESV222N04TL_; ESV222N04TM_; ESV222N04TL_;	6.28 (160)	5.90 (150)	10.99 (279)	9.54 (242)	0.66 (17)	6.31 (160)	.86 (22)	2.00 (51)	2.00 (51)	7.9 (3.58)
AD1	ESV222N02SL_; ESV222N02YM_;	7.12 (181)	6.74 (171)	10.99 (279)	9.54 (242)	0.66 (17)	6.77 (172)	.86 (22)	2.00 (51)	2.00 (51)	9.0 (4.08)
AB1	ESV552N02TM~; ESV752N02TM~ ESV752N04TM~; ESV752N06TM~; ESV752N04TL~	8.04 (204)	7.56 (192)	13.00 (330)	11.04 (280)	0.92 (23)	8.00 (203)	.86 (22)	4.00 (102)	4.00 (102)	13.9 (6.32)
AC1	ESV402N02TM_; ESV402N04TM_; ESV552N04TM_; ESV402N06TM_; ESV552N06TM_; ESV402N04TL_; ESV552N06TL_	8.96 (228)	8.48 (215)	13.00 (330)	11.04 (280)	0.92 (23)	8.04 204)	.86 (22)	4.00 (102)	4.00 (102)	14.7 (6.66)
AE1	ESV113N04TM~; ESV153N04TM~, ESV113N06TM~; ESV153N06TM~	9.42 (240)	8.94 (228)	14.50 (368)	12.54 (319)	0.92 (24)	9.45 (241)	0.73 (19)	4.00 (102)	4.00 (102)	23.0 (10.4)
AF1	ESV113N02TM~; ESV153N02TM~ ESV113N04TL~; ESV153N04TL~ ESV183N04TL~; ESV223N04TL~ ESV183N04TL~; ESV223N04TM~ ESV183N06TM~; ESV223N06TM~	9.42 (240)	8.94 (228)	18.5 (470)	16.54 (420)	0.92 (24)	9.45 (241)	0.73 (19)	4.00 (102)	4.00 (102)	28.5 (12.9)

_ = Last digit of part number: C = N4X Indoor (convection cooled)

~ = Last digit of part number: D = N4X Indoor (fan cooled)

Conduit Hole	Dimensions	Туре	N in (mm)	P in (mm)	Q in (mm)	S in (mm)	S1 in (mm)
0 0	<u>+</u> +-8-4	AA1	3.14 (80)	2.33 (59)	1.50 (38)	.88 (22)	n/a
		AA2	3.14 (80)	4.18 (106)	1.50 (38)	.88 (22)	n/a
		AD1	3.56 (90)	4.63 (118)	1.50 (38)	.88 (22)	n/a
		AB1	4.02 (102)	5.00 (127)	1.85 (47)	1.06 (27)	n/a
		AC1	4.48 (114)	5.00 (127)	1.85 (47)	1.06 (27)	n/a
		AE1	4.71 (120)	5.70 (145)	2.00 (51)	1.375 (35)	1.125 (28)
	N	AF1	4.71 (120)	5.70 (145)	2.00 (51)	1.375 (35)	1.125 (28)

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3.2 Electrical Installation

Installation After a Long Period of Storage



STOP!

Severe damage to the drive can result if it is operated after a long period of storage or inactivity without reforming the DC bus capacitors.

If input power has not been applied to the drive for a period of time exceeding three years (due to storage, etc), the electrolytic DC bus capacitors within the drive can change internally, resulting in excessive leakage current. This can result in premature failure of the capacitors if the drive is operated after such a long period of inactivity or storage.

In order to reform the capacitors and prepare the drive for operation after a long period of inactivity, apply input power to the drive for 8 hours prior to actually operating the motor.

3.2.1 Power Connections



STOP!

If the kVA rating of the AC supply transformer is greater than 10 times the input kVA rating of the drive(s), an isolation transformer or 2-3% input line reactor must be added to the line side of the drive(s).



DANGER! Hazard of electrical shock!

Circuit potentials up to 600 VAC are possible. Capacitors retain charge after power is removed. Disconnect power and wait at least three minutes before servicing the drive.



STOP!

- · Verify mains voltage before connecting to drive.
- · Do not connect mains power to the output terminals (U,V,W)! Severe damage to the drive will result.
- Do not cycle mains power more than once every two minutes. Damage to the drive may result.

. .	Mains and Motor Terminations		
Ą	Туре	Torque	Strip Length
, N	<5HP	12 lb-in (1.3 Nm)	5/16 in (8mm)
	ESV552xx2T, ESV752xx2T, ESV113xx4/6, ESV153xx4/6, ESV183xx6, ESV223xx6	16 lb-in (1.8 Nm)	5/16 in (8mm)
	ESV552xx4Txx, ESV752xx4Txx, ESV552xx6Txx, ESV752xx6Txx	12 lb-in (1.3Nm)	0.25 in (6mm)
	ESV113xx2xxx, ESV153xx2xxx, ESV183xx4xxx, ESV223xx4xxx, ESV303xx4xxx	24 lb-in (2.7 Nm)	7/16 in (10mm)
	ESV373xx4xxx, ESV453xx4xxx	27 lb-in (3.05 Nm)	0.75 in (19mm)
	Torque: N4X/IP65 Door Screws		
	N4X/IP65	6-7 lb-in (0.67-0.79 Nm)	0.25 in (6mm)

3.2.1.1 Mains Connection to 120VAC Single-Phase Supply



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3.2.1.2 Mains Connection to 240VAC Single-Phase Supply



3.2.1.3 Mains Connection to Three-Phase Supply



3.2.1.4 Motor Connection



WARNING!

If the cable connection between the drive and the motor has an in-line contactor or circuit breaker then the drive must be stopped prior to opening/closing the contacts. Failure to do so may result in Overcurrent trips and/or damage to the inverter.

WARNING!

Leakage current may exceed 3.5 mA AC. The minimum size of the protective earth (PE) conductor shall comply with local safety regulations for high leakage current equipment.

STOP

STOP!

In the case of a Spinning Motor:

To bring free-wheeling loads such as fans to a rest before starting the drive, use the DC injection braking function. Starting a drive into a freewheeling motor creates a direct short-circuit and may result in damage to the drive.

Confirm motor suitability for use with DC injection braking. Consult parameter P110 for starting / restarting into spinning motors.

3.2.1.5 Installation Recommendations for EMC Compliance

For compliance with EN 61800-3 or other EMC standards, motor cables, line cables and control or communications cables must be shielded with each shield/screen clamped to the drive chassis. This clamp is typically located at the conduit mounting plate.

The EMC requirements apply to the final installation in its entirety, not to the individual components used. Because every installation is different, the recommended installation should follow these guidelines as a minimum. Additional equipment (such as ferrite core absorbers on power conductors) or alternative practices may be required to meet conformance in some installations.

Motor cable should be low capacitance (core/core <75pF/m, core/shield <150pF/m). Filtered drives can meet the class A limits of EN 55011 and EN 61800-3 Category 2 with this type of motor cable up to 10 meters.

NOTE: Refer to Appendix A for recommended cable lengths. Any external line filter should have its chassis connected to the drive chassis by mounting hardware or with the shortest possible wire or braid.



3.2.1.6 NEMA 4X (IP65) Input Terminal Block

For NEMA 4X (IP65) models with integrated EMC filter and/or integrated line disconnect, the input terminal block is located on the right-hand side of the SMV inverter in the NEMA 4 X (IP65) enclosure. The single and three phase models are illustrated herein. Refer to paragraph 3.2.3 Control Terminals for pin out information.





WARNING

Power remains present for up to 3 minutes on power input terminals (L1, L2 and L3) and output terminals (U, V and W) even when the disconnect switch is in the OFF position. Remove input power ahead of the drive and wait 3 minutes before removing the terminal cover.



3.2.1.7 Dynamic Brake Connections

For NEMA 1 and NEMA 4X Drives rated up to 30HP (22kW) the Dynamic Brake connections are made as illustrated herein. Refer to the SMV Dynamic Brake Instructions (DBV01) for complete information.



The SMV 40...60Hp (30...45kW) models include a dynamic brake transistor as standard and only require the connection of an external resistor kit for dynamic braking operation. The dynamic brake resistor connections for 40...60 Hp (30...45kW) drives are standard built-in connections as illustrated in the diagram below. In the 40Hp (30kW) model drives, the dynamic brake connector is on the right-hand side of the drive and the terminals from top to bottom are B-, BRAKE and B+. In the 50/60HP (37.5/45 kW) model drives, the dynamic brake connector is on the left-hand side of the drive and the terminals from top to bottom are B+, BRAKE and B-.



External resistor kits must be connected to terminals B+ and BRAKE (no connection to B-). Refer to the table herein for external resistor kit selection. Refer to parameter P189 for enabling the dynamic brake function in the 40...60Hp (30...45kW) models.

400/480	VAC SMV In	verter		Resiste	or Kit				
Туре	Нр	kW	Resistance (Ω)	Power (W)	Catalog #	SAP#			
ESV303**4T**	40	30	23.5	1020	841-013	13317724			
ESV373**4T**	50	37	17	1400	841-015	13317626			
ESV453**4T**	60	45	17	1400	841-015	13317626			
600 V	AC SMV Inve	rter	Resistor Kit						
Туре	Нр	kW	Resistance (Ω)	Power (W)	Catalog #	SAP#			
ESV303**6T**	40	30	35	1070	841-014	13317624			
ESV373**6T**	50	37	24	1560	841-016	13317628			
ESV453**6T**	60	45	24	1560	841-016	13317628			





3.2.2 **Fuses/Cable Cross-Sections**

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NOTE: Observe local regulations. Local codes may supersede these recommendations

		Recommendations						
	Туре	Fuse	Miniature circuit breaker ⁽¹⁾	Fuse ⁽²⁾ or Breaker ⁽³⁾	Input Pov (L1, L2,	Input Power Wiring (L1, L2, L3, PE)		
				(N. America)	[mm ²]	[AWG]		
	ESV251N01SXB	M10 A	C10 A	10 A	1.5	14		
120V	ESV371N01SXB, ESV371N01SX*	M16 A	C16 A	15 A	2.5	14		
1~ (1/N/PE)	ESV751N01SXB, ESV751N01SX*	M25 A	C25 A	25 A	4	10		
(1,1,1,1,2)	ESV112N01SXB, ESV112N01SX*	M32 A	C32 A	30A	4	10		
	ESV251N01SXB, ESV251N02SXB, ESV371N01SXB, ESV371N02YXB, ESV371N02SF*	M10 A	C10 A	10 A	1.5	14		
240V	ESV751N01SXB, ESV751N02YXB, ESV751N02SF*	M16 A	C16 A	15 A	2.5	14		
1~ (2/PE)	ESV112N02YXB, ESV112N02SFC, ESV112N01SXB ESV112N01SX*	M20 A	C20 A	20 A	2.5	12		
	ESV152N02YXB, ESV152N02SF*	M25 A	C25 A	25 A	2.5	12		
	ESV222N02YXB, ESV222N02SF*	M32 A	C32A	30 A	4	10		
	ESV371N02YXB, ESV751N02YXB, ESV371N02Y_*, ESV751N02Y_*	M10 A	C10 A	10 A	1.5	14		
	ESV112N02YXB, ESV152N02YXB, ESV112N02TXB, ESV152N02TXB, ESV112N02Y_*, ESV152N02Y_*	M16 A	C16 A	12 A	1.5	14		
240V	ESV222N02YXB, ESV222N02TXB, ESV222N02YX*	M20 A	C20 A	20 A	2.5	12		
3~	ESV402N02TXB, ESV402N02T_*	M32 A	C32 A	30 A	4.0	10		
(3/PE)	ESV552N02TXB, ESV552N02T_~	M40 A	C40 A	35 A	6.0	8		
	ESV752N02TXB, ESV752N02T_~	M50 A	C50 A	45 A	10	8		
	ESV113N02TXB, ESV113N02TX~, ESV113N02TM~	M80 A	C80 A	80 A	16	6		
	ESV153N02TXB, ESV153N02TX~, ESV153N02TM~	M100 A	C100 A	90 A	16	4		
	ESV371N04TXBESV222N04TXB ESV371N04T_*ESV222N04T_* ESV371N04TF*ESV222N04TF*	M10 A	C10 A	10 A	1.5	14		
400V	ESV302N04T_*	M16 A	C16 A	15 A	2.5	14		
3~(3/PE)	ESV402N04TXB, ESV402N04T_*	M16 A	C16 A	20 A	2.5	14		
	ESV552N04TXB, ESV552N04T_*	M20 A	C20 A	20 A	2.5	14		
	ESV752N04TXB, ESV752N04T_~	M25 A	C25 A	25 A	4.0	10		
	ESV113N04TXB, ESV113N04T_~	M40 A	C40 A	40 A	4	8		
	ESV153N04TXB, ESV153N04T_~	M50 A	C50 A	50 A	10	8		
400V	ESV183N04TXB, ESV183N04T_~	M63 A	C63A	70 A	10	6		
or 480V	ESV223N04TXB, ESV223N04T_~	M80 A	C80 A	80 A	16	6		
3~(3/PE)	ESV303N04TXB	M100 A	C100 A	100 A	25	4		
	ESV373N04TXB	M125 A	C125 A	125 A	35	2		
	ESV453N04TXB	M160 A	C160 A	150 A	35	1		
	ESV751N06TXBESV222N06TXB ESV751N06T_*ESV222N06T_*	M10 A	C10 A	10 A	1.5	14		
	ESV402N06TXB, ESV402N06T_*	M16 A	C16 A	12 A	1.5	14		
	ESV552N06TXB, ESV552N06T_*	M16 A	C16 A	15 A	2.5	14		
	ESV752N06TXB, ESV752N06T_~	M20 A	C20 A	20 A	2.5	12		
6001	ESV113N06TXB, ESV113N06TX~, ESV113N06TM~	M32 A	C32 A	30 A	4	10		
3~(3/PE)	ESV153N06TXB, ESV153N06TX~, ESV153N06TM~	M40 A	C40 A	40 A	4	8		
	ESV183N06TXB, ESV183N06TX~, ESV183N06TM~	M50 A	C50 A	50 A	6	8		
	ESV223N06TXB, ESV223N06TX~, ESV223N06TM~	M63 A	C63 A	60 A	10	8		
	ESV303N06TXB	M80 A	C80 A	70 A	16	6		
	ESV373N06TXB	M100 A	C100 A	90 A	16	4		
	ESV453N06TXB	M125 A	C125 A	110 A	25	2		



Notes for Fuse and Cable Table:

(1) Installations with high fault current due to large supply mains may require a type D circuit breaker.

(2) UL Class CC or T fast-acting current-limiting type fuses, 200,000 AIC, preferred. Bussman KTK-R, JJN or JJS or equivalent. (3) Thermomagnetic type breakers preferred.

_ 11th digit of part number:	F = Integral EMC Filter
	L = Integral EMC Filter and Integrated Disconnect Switch (NEMA 4X/IP65 Models only)
	M = Integrated Disconnect Switch (NEMA 4X/IP65 Models only)
	X = No EMC Filter/ No Disconnect Switch
* = Last digit of part number:	C = N4X Indoor only (convection cooled)
	E = N4X Indoor/Outdoor (convection cooled)
~ = Last digit of part number:	D = N4X Indoor only (fan cooled)
	F = N4X Indoor/Outdoor (fan cooled)

Observe the following when using Ground Fault Circuit Interrupters (GFCIs):

- · Installation of GFCI only between supplying mains and controller.
- The GFCI can be activated by:
 - capacitive leakage currents between the cable screens during operation (especially with long, screened motor cables)
 connecting several controllers to the mains at the same time
 - RFI filters

3.2.3 Control Terminals

Control Terminal Strip for 0.33 - 10 HP (0.25 - 7.5 kW):



Control Terminal Strip for 15HP (11 kW) and Greater Drives:



NOTE

Control and communications terminals provide basic insulation when the drive is connected to a power system rated up to 300V between phase to ground (PE) and the applied voltage on terminals 16 and 17 is less than 250 VAC between phase to phase and ground (PE).



Control Terminal Strip Descriptions

Terminal	Description	Important		
1	Digital Input: Start/Stop	input resistance = $4.3k\Omega$		
2	Analog Common			
5	Analog Input: 010 VDC	input resistance: >50 k Ω		
6	Internal DC supply for speed pot	+10 VDC, max. 10 mA		
25	Analog Input: 420 mA	input resistance: 250Ω		
4	Digital Reference/Common	+15 VDC / 0 VDC, depending on assertion level		
11	Internal DC supply for external devices	+12 VDC, max. 50 mA		
13A	Digital Input: Configurable with P121			
13B	Digital Input: Configurable with P122	input resistance – 4.2kO		
13C	Digital Input: Configurable with P123			
13D*	Digital Input: Configurable with P124			
14	Digital Output: Configurable with P142, P144	DC 24 V / 50 mA; NPN		
30	Analog Output: Configurable with P150P155	010 VDC, max. 20 mA		
2*	Analog Common			
TXA*	RS485 TxA			
TXB*	RS485 TxB			
16	Dolou output: Configurable with D140. D144	AC 250 V / 3 A		
17	Relay output: configurable with P140, P144	DC 24 V / 2 A 240 V / 0.22 A, non-inductive		

* = Terminal is part of the terminal strip for the 15HP (11kW) and higher models only.

Assertion level of digital inputs

The digital inputs can be configured for active-high or active-low by setting the Assertion Level Switch (ALsw) and P120. If wiring to the drive inputs with dry contacts or with PNP solid state switches, set the switch and P120 to "High" (+). If using NPN devices for inputs, set both to "Low" (-). Active-high (+) is the default setting.

 $\begin{array}{l} HIGH=+12\ \dots\ +30\ V\\ LOW=0\ \dots\ +3\ V \end{array}$



NOTE

An *F_RL* fault will occur if the Assertion Level switch (ALsw) position does not match the parameter P120 setting and P100 or any of the digital inputs (P121...P124) is set to a value other than 0.



4 Commissioning

4.1 Local Keypad & Display



Display	START BUTTON
RUN	In Local Mode (P100 = 0, 4, 6), this button will start the drive.
	STOP BUTTON
\bigcirc	Stops the drive, regardless of which mode the drive is in.
STOP	WARNING! When JOG is active, the STOP button will not stop the drive!
	ROTATION
RF	In Local Mode (P100 = 0, 4, 6), this selects the motor rotation direction: - The LED for the present rotation direction (FWD or REV) will be on - Press R/F; the LED for the opposite rotation direction will blink - Press M within 4 seconds to confirm the change - The blinking direction LED will turn on, and the other LED will turn off
	When rotation direction is changed while the drive is running, the commanded direction LED will blink until the drive is controlling the motor in the selected direction. Rotation is set in P112. When P112 = 0, rotation is forward only. When P112 = 1 rotation is forward and reverse.
	MODE
	Used to enter/exit the Parameter Menu when programming the drive and to enter a changed parameter value.
	UP AND DOWN BUTTONS
	Used for programming and can also be used as a reference for speed, PID setpoint, or torque setpoint. When the ▲ and ▼ buttons are the active reference, the middle LED on the left side of the display will be on.

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Display	INDICATING LEDs (on 4-character display)						
	FWD LED: Indicate the present rotation direction is forward. Refer to ROTATION description above.						
	REV LED: Indicate the present rotation direction is reverse. Refer to ROTATION description above.						
	AUTO LED: Indicates that the drive has been put into Auto mode from one of the TB13 inputs (P121P124 set to 17). Indicates that PID mode is active (if PID mode is enabled). Indicates that sequencer mode is active (if sequencer mode is enabled).						
	RUN LED: Indicates that the drive is running.						
••- ·/ –	▲ ▼ LED: Indicates that	at the ▲ ▼ are the ac	tive reference.				
	• NOTE If the keypad is selected as the auto reference (P121P124 is 6) and the corresponding TB-13 input is closed, the AUTO LED and ▲ ▼ LEDs will both be on.						
	FUNCTIONS THAT FOLLOW ARE APPLICABLE TO SMV DRIVES 15HP (11kW) AND HIGHER						
CTRL	CTRL The CTRL pushbutton selects the start and speed reference control sources for the drive.						
	CTRL LEDs		START CONTROL	REFERENCE CONTROL			
		[LOCAL] [MAN]	Keypad	P101 Settings			
		[LOCAL] [AUTO]	Keypad	Terminal 13x Settings			
	REMOTE # MAN LOCAL // //AUTO	[Remote] [Man]	Terminal Strip	P101 Settings			
	REMOTE DAN LOCAL D AUTO	[Remote] [Auto]	Terminal Strip	Terminal 13x Settings			
	If P100 = 6 the CTRL buttor start control between the and the keypad [LOCAL]	on is used to toggle terminal strip [REMOTE]	- REM/LOC LED indicating the present start control source is ON - Press [CTRL]; the LED for other start control source will blink - Press [M] within 4 sec to confirm the change - Blinking LED will turn ON (the other LED will turn OFF)				
	If P113 = 1 the CTRL button is used to toggle reference control between the TB-13x setup [AUT0] and P101 [MANUAL] - AUT/MAN LED indicating present reference control is ON - Press [CTRL]; the other reference control will blik - Press [M] within 4 sec to confirm change - Blinking LED will turn ON (the other LED will turn OFF)						
	If $P100 = 6$ and $P113 = 1$ change the start and refer the same time	, it is possible to ence control sources at					



Display	START CONTROL					
	The REMOTE/LOCAL LEDs indicate the current start control source. If the start control source is a remote keypad or the network, then both LEDs will be OFF.					
	REFERENCE CONTROL The AUTO/MANUAL LEDs indicate the current reference control source.					
	IF P113 = 0 or 2, the AUTO/MANUAL LEDs will match the AUTO LED on the 4-character display. IF P113 = 0 and no AUTO reference has been setup on the terminal strip, the MANUAL LED will turn ON and the AUTO LED will turn OFF. IF P113 = 1, the AUTO/MANUAL LEDS show the commanded reference control source as selected by the [CTRL] button. If the [CTRL] button is used to set the reference control source to AUTO but no AUTO reference has been setup on the terminal strip, reference control will follow P101 but the AUTO LED will remain ON.					
	UNITS LEDs					
	HZ: current display value is in Hz	In Speed mode, if P178 = 0 then HZ LED will be ON. If				
	%: current display value is in %	P178 > 0, the Units LEDs follow the setting of P177 when				
	RPM: current display value is in RPM	the drive is in run (non-programming) mode.				
	AMPS: current display value is in Amps	in run (non-programming) mode.				
	/UNITS current display value is a per unit (i.e./sec, /min, /hr, etc.)	In Pid mode, the Units LEDs follow the setting of P203 when the drive is in run (non-programming) mode. If P179 > 0, the Units LEDs will show the unit of the diagnostic parameter that is being displayed.				

4.2 Drive Display and Modes of Operation

Speed Mode Display

In the standard mode of operation, the drive frequency output is set directly by the selected reference (keypad, analog reference, etc.). In this mode, the drive display will show the drive's output frequency.

PID Mode Display

When the PID mode is enabled and active, the normal run display shows the actual PID setpoint. When PID mode is not active, the display returns to showing the drive's output frequency.

Torque Mode Display

When the drive is operating in Vector Torque mode, the normal run display shows the drive's output frequency.

Alternate (Run-Screen) Display

When P179 (Run Screen Display) is set to a value other than 0, one of the diagnostic parameters (P501...P599) is displayed. Example: if P179 is set to 1, then diagnostic parameter P501 (Software version) is displayed. If P179 =2, then P502 (Drive ID) is displayed.





Parameter Setting

4.3

Electronic Programming Module (EPM) 4.4

The EPM contains the drives operational memory. Parameter settings are stored in the EPM and setting changes are made to the "User settings" in the EPM.

An optional EPM Programmer (model EEPM1RA) is available that allows:

- · An EPM to be copied directly to another EPM.
- An EPM to be copied to the memory of the EPM Programmer.
- Stored files can be modified in the EPM Programmer.
- · Stored files can be copied to another EPM.



EPM Module in SMV Drive

As the EPM Programmer is battery operated, parameter settings can be copied to an EPM and inserted into a drive without power being applied to the drive. This means that the drive will be fully operational with the new settings on the next application of power.

Additionally, when the drives parameter settings are burned into an EPM with the EPM Programmer, the settings are saved in two distinct locations; the "User settings" and the "OEM default settings". While the User settings can be modified in the drive, the OEM settings cannot. Thus, the drive can be reset not only to the "factory" drive default settings (shown in this manual), but can be set to the Original Machine settings as programmed by the OEM.

The user area contents of the EPM are what are copied into the OEM space by the EPM programmer. When parameter modifications are made to the drive and then a copy made via the EPM Programmer, these are the settings that will be available by the OEM selections from P199. The EPM Programmer is the only way to load the OEM area of the EPM.

While the EPM can be removed for copying or to use in another drive, it must be installed for the drive to operate (a missing EPM will trigger an F_F I fault)



4.5 Parameter Menu

4.5.1 Basic Setup Parameters

Code		Possible Settings		INDODIANT	
No.	Name	Default	Selection	IMPORTANT	
P 100	Start Control Source	0	0 Local Keypad	Use RUN button on front of drive to start	
			1 Terminal Strip	Use start/stop circuit wired into the terminal strip. Refer to section 3.2.3	
			2 Remote Keypad Only	Use RUN button on optional Remote Keypad to start	
			3 Network Only	 Start command must come from network (Modbus, CANopen, etc) SMV models <15HP (11kW) require optional communication module (refer to the network module documentation). Must also set one of the TB-13 inputs to 9 (Network Enable); see P121P124 	
			4 Terminal Strip or Local Keypad	Allows start control to be switched between terminal strip and local keypad using one of the TB-13 inputs. See note below.	
			5 Terminal Strip or Remote Keypad	Allows start control to be switched between terminal strip and optional remote keypad using one of the TB-13 inputs. See Note below	
			6 CTRL button select	Allows start control to be switched between terminal strip and local keypad using the CTRL button. NOTE: P100 Selection 6 is applicable to SMV 15HP (11kW) and higher models only.	
		⚠	WARNING! P100 = 0 disables TB-1 as a STOP input reset back to defaults (see P199)	STOP circuitry may be disabled if parameters are	
		1	 NOTE P100 = 4, 5: To switch between cont must be set to 08 (Control Select); TB-13x OPEN (or not configured): Ter TB-13x CLOSED: Local (P100 = 4) or P100 = 0, 1, 4, 6: Network can take TB-13x input is CLOSED. The STOP button on the front of the cont TB-1 is an active STOP input if P100 An F_RL fault will occur if the Asser the P120 setting and P100 is set to 	rol sources, one of the TB-13 inputs (P121P124) minal strip control Remote (P100 = 5) keypad control if P121P124 = 9 and the corresponding Irive is always active except in JOG mode. is set to a value other than 0. tion Level switch (ALsw) position does not match o a value other than 0.	
P 10 1	Standard Reference Source	0	0 Keypad (Local or Remote) 1 0-10 VDC 2 4-20 mA 3 Preset #1 (P131) 4 Preset #2 (P132) 5 Preset #3 (P133) 6 Network	Selects the default speed or torque reference when no Auto Reference is selected using the TB-13 inputs.	
			 Preset Sequence Segment #1 (P710) Preset Sequence Segment #2 (P715) Preset Sequence Segment #3 (P720) 	Selections 7, 8 & 9 are not valid for PID setpoint or torque reference.	



Code		Possible	Settings		IMPORTANT
No.	Name	Default	Selection		IMPORIANI
P 102	Minimum Frequency	0.0	0.0 {Hz}	P103	P102, P103 are active for all speed
P 103	Maximum Frequency	60.0	7.5 {Hz}	500	eferences When using an analog speed reference, also see P160, P161
		1	 NOTE P103 cannot be set beli To set P103 above 120 Scroll up to 120 Hz; d Release	ow Minimum F Hz: isplay shows F d wait one sec to continue in	Frequency (P102) H.F.F. (flashing). ond. ucreasing P103.
\triangle	WARNING! Consult motor/machin damage to equipment	ie manufa	cturer before operating abov v to personnel!	e rated freque	ncy. Overspeeding the motor/machine may cause
P 104	Acceleration Time 1	20.0	0.0 {s}	3600	 P104 = time of frequency change from 0 Hz to P167 (base frequency) P105 = time of frequency change from P167
P 105	Deceleration Time 1	20.0	0.0 {s}	3600	 For S-ramp accel/decel, adjust P106
i	EXAMPLE: IF P103 = Hz to 120 Hz = 40.0 s	120 Hz, P	104 = 20.0 s and P167 (bas	e frequency) =	= 60 Hz; then the rate of frequency change from 0
P 106	S-Ramp Integration Time	0.0	0.0 {s}	50.0	 P106 = 0.0: Linear accel/decel ramp P106 > 0.0: Adjusts S-ramp curve for smoother ramp
P 101(1)	Line Voltage Selection	1*	0 Low (120, 200, 400, 48 1 High (120, 240, 480, 60	OVAC)	* The default setting is 1 for all drives except when using "Reset to 50Hz default settings" (Parameter P199, selection 4) with 480V models. In this case, the default setting is 0.
P 108	Motor Overload	100	30 {%}	100	P108 = <u>motor current rating</u> x 100 SMV output rating Example: if motor = 3amps and SMV = 4amps, then P108 = 75%
		i	NOTE Do not set above rated mo overload function of the SM an overload fault could resu	tor current as / is UL approve .lt in significar	listed on the motor dataplate. The motor thermal ed as a motor protection device. Cycling power after ttly reducing the motor life.
P 109	Motor Overload Type	0	0 Speed Compensation		
			1 No Speed Compensatio Example: Motor is coole ventilation as apposed to sl self cooling fans.	n ed by forced haft mounted,	

(1) Any changes to this parameter will not take effect until the drive is stopped.



Code Possi		Possible	Settings	IMPOPTANT
No.	Name	Default	Selection	IMPORTANT
P I 10	Start Method	0	0 Normal	
			1 Start on Power-up	Drive will automatically start when power is applied.
			2 Start with DC Brake	When start command is applied, drive will apply DC braking according to P174, P175 prior to starting the motor
			3 Auto Restart	Drive will automatically restart after faults, or when power is applied.
			4 Auto Restart with DC Brake	Combines settings 2 and 3
			5 Flying Start/Restart - Type 1	 Drive will automatically restart after faults, or when power is applied. After 3 failed attempts, drive will Auto Restart
			6 Flying Start/Restart - Type 1	 with UC brake. P110 = 5, 7: Performs speed search, starting at Max Frequency (P103) P110 = 6 8: Performs speed search starting
			7 Flying Start /Restart - Type 2 for 2-pole motors requiring a flying restart	 at the last output frequency prior to faulting or power loss If P111 = 0, a flying START is performed when
			8 Flying Start/Restart - Type 2 for 2-pole motors requiring a flying restart	 a start command is applied. P110 = 7,8: Utilizes P280/281 to set Max Current Level and Decel Time for restart
		i	 NOTE P110 = 0, 2: Start command must be fault will occur if start command is ap P110 = 1, 36: For automatic start/ and the start command must be press P110 = 2, 46: If P175=999.9, dc b P110 = 36: Drive will attempt 5 re (fault lockout) and requires manual re P110 = 5, 6: If drive cannot catch the P110 = 5, 6: If drive trips into F_DF 	e applied at least 2 seconds after power-up; $F_{-}UF$ splied too soon. restart, the start source must be the terminal strip ent. raking will be applied for 15s. starts; if all restart attempts fail, drive displays <i>LC</i> set. spinning motor, drive will trip into <i>F_rF</i> fault. fault, try P110 = 7 or 8.
⚠	WARNING! Automatic starting/res	tarting ma	' y cause damage to equipment and/or injury	to personnel! Automatic starting/restarting should
	only be used on equip	ment that	is inaccessible to personnel.	
PIII	Stop Method	0	0 Coast	Drive's output will shut off immediately upon a stop command, allowing the motor to coast to a stop
			1 Coast with DC Brake	The drive's output will shut off and then the DC Brake will activate (refer to P174, P175)
			2 Ramp	The drive will ramp the motor to a stop according to P105 or P126.
			3 Ramp with DC Brake	The drive will ramp the motor to 0 Hz and then the DC Brake will activate (refer to P174, P175)
P I 12	Rotation	0	0 Forward Only	If PID mode is enabled, reverse direction is disabled
			1 Forward and Reverse	(except for Jog).

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Commissioning

Code		Possible	Settings	IMDODTANT	
No.	Name	Default	Selection		
P 13 Auto/Manual Control	0	0 Terminal Strip Control	The reference is dictated by the settings and state of the TB-13x terminals. If no AUTO reference has been setup on the terminal strip then reference control is dictated by P101.		
		i	1 Auto/Manual (CTRL button select)	Allows the reference to be switched between auto and manual using the CTRL pushbutton on the drive keypad. If the CTRL pushbutton has selected AUTO reference but no AUTO reference has been setup on the terminal strip, then reference control is dictated by P101.	
			2 Manual Control Only	Reference is dictated by P101 regardless of any AUTO source that may be selected by the TB-13x terminals.	
			NOTE P113 is applicable to SMV 15HP (11kW) a	and higher models only.	
P I 15	MOP Speed	0	0 Set to last MOP speed at power up	Output frequency at power-up = last MOP speed	
	Initialization at		1 Set to 0.0Hz at power up	Output frequency at power-up = 0Hz	
	Power-Up		2 Set to Preset #3 (P133) at power up	Output frequency at power-up = P133	



4.5.2 I/O Setup Parameters

Code		Possible Settings				
No.	Name	Default	Selection	IMPORTANT		
P 120	Assertion Level	2	1 Low 2 High	P120 and the Assertion Level switch must both match the desired assertion level unless P100, P121P124 are all set to 0. Otherwise an F.AL fault will occur.		
P 12 1	TB-13A Digital Input	0	0 None	Disables input		
			1 AUTO Reference: 0-10 VDC	For frequency mode, see P160P161,		
P 122	TB-13B Digital Input		2 AUTO Reference: 4-20 mA	For PID mode, see P204P205, For vector torque mode, see P330		
	(Priority > TB13A) Same as TB13A except:		3 AUTO Reference: Preset #1	For frequency mode see P131P137, For PID mode, see P231P233,		
	3 = Preset #2		* 13D: 3 = Reserved	For torque mode see, P331P333		
	23 = Seq Sey, #2		4 AUTO Reference: MOP Up	 Normally open: Close input to increase or decrease speed PID or torgue setucint 		
P 123	TB-13C Digital Input		5 AUTO Reference: MUP Down	MOP Up is not active while in STOP		
	(Priority > 1813B, A) Same as TB13A excent:		6 AUTO Reference: Keypad			
	3 = Preset #3		7 AUTO Reference: Network			
	23 = Seq Seg, #4		8 Control Select	Use when $P100 = 4$, 5 to switch between terminal strip control and local or remote keypad control.		
P 124	TB-13D* Digital Input		9 Network Enable	Required to start the drive through the network.		
	(Priority > TB13C, B, A)		10 Reverse Rotation	Open = Forward Closed = Reverse		
	Same as TB13A except:		11 Start Forward	Refer to Note for typical circuit		
	3 = Preset #4 23 = Seg Seg #8		12 Start Reverse			
	20 - 000 0000, "0		13 Run Forward	Refer to Note for typical circuit		
	:		14 Run Reverse			
			15 Jog Forward	Jog Forward speed = P134		
	NOTE: P124 is		16 Jog Reverse	Jog Reverse speed = P135		
	15HP (11kW) and		17 Accol/Decol #2	$\sum_{i=1}^{n} Active even if P 12 = 0$		
	higher models only		18 DC Brake	Refer to P174: close input to override P175		
			19 Auxiliary Ramp to Stop	Normally closed: Opening input will ramp drive to STOP according to P127, even if P111 is set to Coart (0 or 1)		
			20 Clear Fault	Close to reset fault		
			21 External Fault E EE	Normally closed circuit: open to trip		
				Normally open circuit: close to trip		
			23 AUTO Ref: Sequence Segment #1	Works in Speed Mode only		
			24 Start Sequence			
			25 Step Sequence	Transition from non-asserted to asserted state		
			26 Suspend Sequence			
	WARNING					
	Jog overrides all STOP commands! To stop the drive while in Jog mode, the Jog input must be deactivated or a fault condition induced.					
Â	WARNING					
	If the input defined to	o "Start Se	equence" is opened during a sequence,	the drive will exit sequencer mode and will run		
	at the specified standard or alternate speed source (dependent on drive configuration).					



Code	Possible Settings			IMPORTANT							
No.	Name	Default	Selectio	n		IMPORTANT					
İ	 NOTE When input is activated, settings 17 override P101 When TB-13ATB-13D are configured for Auto References other than MOP, TB-13D overrides TB-13C, TB-13C overrides TB-13B and TB-13B overrides TB-13A. Any other Auto Reference will have priority over MOP. Settings 1014 are only valid in Terminal Strip mode (P100 = 1, 4, 5, 6) If Start/Run/Jog Forward and Start/Run/Jog Reverse are both activated, drive will STOP If Jog input is activated while drive is running, the drive will enter Jog mode; when Jog input is deactivated, drive will STOF An <i>F</i>_<i>R</i>L fault will occur if the Assertion Level switch (ALsw) position does not match the P120 setting and any of the digita inputs (P121P124) are set to a value other than 0. An <i>F</i>_<i>I</i>L fault will occur under the following conditions: TB-13ATB-13D settings are duplicated (each setting, except 0, 3 and 23, can only be used once) One input is set to 10 and another input is set to 1114. One input is set to 11 or 12 and another input is set for 13 or 14. Typical control circuits are shown below: If any input is set to 10, 12 or 14, P112 must be set to 1 for Reverse action to function. 										
	Run / Stop with Direction P121 = 10 1 4 13A stop PWD RUN REV			Start Forwar Start Rever P121 = 11, P12 1 4 13/ FWD STOP	rd / se 2 = 12 A 13B	Run Forward / Run Reverse P121 = 13, P122 = 14 1 4 13A 13B RUN RVD RUN RVD RVD					
P 125	Acceleration Time 2	20.0	0.0	{S}	3600	• Selected using TB-13ATB-13D (P121					
P 126	Deceleration Time 2	20.0	0.0	{S}	3600	P124 = 17) • For S-ramp accel/decel, adjust P106					
P IZT	Deceleration Time for Auxiliary Ramp to Stop	20.0	0.0	{s}	3600	 Selected using TB-13ATB-13D (P121 P124 = 19). For S-ramp accel/decel, adjust P106 Once executed, this ramp time has priority over P105 and P126. 					
P 129	Automatic Accel/ Decel rate switch threshold	0.0	0.0	{Hz}	1000	If Actual Frequency < P129 Use Accel/decel time #2 (P125/P126) If Actual Frequency > P129 Use Accel/decel time #1 (P104/P105)					
PIJI	Preset Speed #1	0.0	0.0	{Hz}	500	PRESET 13A 13B 13C 13D					
P 132	Preset Speed #2	0.0	0.0	{Hz}	500	1 X					
P 133	Preset Speed #3	0.0	0.0	{Hz}	500	2 X 3 X					
יובו ס	Preset Speed #4	0.0	0.0	{H7}	500	4 X X					
		0.0		ر ۲۰ تا		4 (alternate) X					
P 135	Preset Speed #5	0.0	0.0	{Hz}	500	5 X X 6 X X					
P 136	Preset Speed #6	0.0	0.0	{Hz}	500	7 X X X 8 (alternate) X X					
רפו יי	Preset Speed #7	0.0	0.0	{Hz}	500	8 (alternate X X					
P 138	Preset Speed #8	0.0	0.0	{Hz}	500	 Speed setting is used by P158 13D available on 15HP (11kW) & higher drives. 					

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Code		Possible	Settings			
No.	Name	Default	Selection	IMPORTANT		
P 140	Relay Output	0	0 None	Disables the output		
	TB-16, 17		1 Run	Energizes when the drive is running		
			2 Reverse	Energizes when reverse rotation is active		
			3 Fault	De-energizes when the drive trips, or power is removed		
			4 Inverse Fault	Energizes when the drive trips		
			5 Fault Lockout	P110 = 36: De-energizes if all restart attempts fail		
			6 At Speed	Energizes when output frequency = commanded frequency		
			7 Above Preset Speed #6	Energizes when output frequency > P136		
			8 Current Limit	Energizes when motor current = P171		
			9 Follower Loss (4-20 mA)	Energizes when 4-20 mA signal is < P164		
			10 Loss of Load	Energizes when motor load drops below P145; Refer to P146 also		
			11 Local Keypad Control Active			
			12 Terminal Strip Control Active	Energizes when the selected source is active for		
			13 Remote Keypad Control Active	start control		
			14 Network Control Active			
			15 Standard Reference Active	Energizes when P101 reference is active		
			16 Auto Reference Active	Energizes when Auto Reference is activated using TB-13 input; refer to P121P124		
			17 Sleep Mode Active	Refer to P240P242		
			18 PID Feedback < Min. Alarm	Energizes when PID feedback signal < P214		
			19 Inverse PID Feedback < Min. Alarm	De-energizes when PID feedback signal < P214		
			20 PID Feedback > Max Alarm	Energizes when PID feedback signal > P215		
			21 Inverse PID Feedback > Max Alarm	De-energizes when PID feedback signal > P215		
					22 PID Feedback within Min/Max Alarm range	Energizes when PID feedback signal is within the Min/Max Alarm range; refer to P214, P215
			23 PID Feedback outside Min/Max Alarm range	Energizes when PID feedback signal is outside the Min/Max Alarm range; refer to P214, P215		
			24 Reserved			
			25 Network Controlled	SMV models < 15HP (11kW) require an optional communication module (refer to the network module documentation).		
			26 Loss of 0-10V Input	Energizes when 0-10V signal is < P158		
			27 Sequencer Controlled	State set in individual sequencer segments		
			28 Sequencer Active			
			29 Sequencer Suspended			
			30 Sequence Done	End Sequence		
			31 Output Frequency = 0.0Hz	Output inactive		
P 142	TB-14 Output	0	023 (same as P140)			
			24 Dynamic Braking	For use with Dynamic Braking option		
			2531 (same as P140)			



Code		Possible Settings						IMPOPTANT			
No.	Name	Default	Sel	ection				IMPORTANT			
P 144	Digital Output Inversion			P144 0 1 2 3	Invert P142 N0 N0 YES YES	Invert P140 N0 YES N0 YES		Used to invert the selections for P140 (Relay Output) and P142 (TB-14 Output). EXAMPLE: When P140 = 6 (AT SPEED), the relay is energized when output frequency = commanded frequency. IF P144=1 or 3, then P140 is inverted (INVERSE AT SPEED) and the relay is energized when the output frequency does not equal the command frequency.			
		i	NO Inve ene	rE erting P140 rgized cont	or P142 wł inuously.	ien the para	ame	ter is set to NONE (0) will result in the output being			
		i	For soft	SMVector (ware versic	drives rateo ons 3.0 and	l at 0.33 to higher (refe	10 er to	HP (0.25 to 7.5 kW), P144 is only available with P501).			
P 145	Loss of Load Threshold	0	0		{%}	200		P140, P142 = 10: Output will energize if motor load falls below the P145 value longer than the			
P 146	Loss of Load Delay	0.0	0.0		{S}	240.0		P146 time			
P 149	Analog Output Offset	0.0	0		{%}	100		Scaled value. Example: $P149 = 10\%$, Scaled variable = freq, $P150 = 1$, $P152 = 60Hz$; then TB30 = 0VDC below 6Hz			
P 150	TB-30 Output	0	0 None 1 0-10 VDC Output Frequency 2 2-10 VDC Output Frequency 3 0-10 VDC Load 4 2-10 VDC Load 5 0-10 VDC Torque 6 2-10 VDC Torque 7 0-10 VDC Power (kW) 8 2-10 VDC Power (kW) 9 Network Controlled			uency uency		2-10 VDC signal can be converted to 4-20 mA with a total circuit impedance of 500 Ω SMV models < 15HP (11kW) require an optional communication module (refer to the network module documentation).			
	TD 20 Cooling	<u> </u>	10	Sequencer	Controlled	0000		Value set in individual sequencer segments			
P 152	Frequency	0.0	3.0		{HZ}	2000		equals 10 VDC			
P 153	TB-30 Scaling: Load	200	10		{%}	500		If $P150 = 3$ or 4, sets the Load (as a percent of drive current rating) at which output equals 10 VDC.			
P 154	TB-30 Scaling: Torque	100	10		{%}	1000		If P150 = 5 or 6, sets the Torque (as a percent of motor rated torque) at which output equals 10 VDC			
P 155	TB-30 Scaling: Power (kW)	1.0	0.1		{kW}	200.0		If $P150 = 7$ or 8, sets the power at which output equals 10 VDC			



4.5.3 Advanced Setup Parameters

Code		Possible	Settings			IMPODIANT
No.	Name	Default	Selection			IMPORTANT
P 156	Analog Inputs	0	0 TB5: (0-	-10 VDC); TB25	: (4-20mA)	
	Configuration		1 TB5: (0	- 5 VDC); TB25	: (4-20mA)	
			2 TB5: (2	- 10 VDC); TB2	5: (4-20mA)	
			4 TB5: (0-	-10 VDC); TB25	: (0-20mA)	
			5 TB5: (0	- 5 VDC); TB25	: (0-20mA)	
			6 TB5: (2	- 10 VDC); TB2	5: (0-20mA)	
P 157	TB5 (0-10V) Analog	0	0 No Actio	on		Selects the reaction to a loss of the 0-10V signal
	Input Monitoring		1 If TB5 <	: P158 - Trip Fa	ult F_FAU	at TB5
	ACUON		2 If TB5 <	< P158 - Run Pr	eset #8	500ms is the minimum time above/below
			3 If TB5 <	< P158 - Run Pr	eset Seg. #16	Monitoring Level (P158) before triggering the
			4 If TB5 >	P158 - Trip Fa	ult F_FRU	drive to trip or run at a preset speed.
			5 If TB5 >	> P158 - Run Pr	eset #8	For P157 = 3 or 6, the accel/decel time is set
			6 If TB5 >	P158 - Run Pr	eset Seg. #16	IN P786. NOTE: P157 has priority over P163 and TB-13
						presets/auto references (P121-P124)
P 158	TB5 (0-10V) Analog	0.0	-10.0	{VDC}	10.0	Negative input voltage is not currently supported.
	Level (ML)					
P 159	0-10V Analog Input	0.0	0	{VDC}	10.0	Not active if [-10 to +10 VDC] option is selected.
0.00	Deadband Speed at Minimum	0.0	000.0	(11-)	1000	
P 16U	Signal	0.0	-999.0	{Π2}	1000	
P 16 I	Speed at Maximum Signal	60.0	-999.0	{Hz}	1000	0V 10V ref (4mA) (20mA) P160
						I V0111
		i	NOTE • P160 se • P161 se • P160 or • P160 >	ets the output fr ets the output fr P161 < 0.0 Hz P161: Drive wi	equency at 0% equency at 10 :: For scaling p Il react inverse	o analog input 0% analog input urposes only; does not indicate opposite direction! ly to analog input signal
P 162	Analog Input Filter	0.01	0.00	{S}	10.00	Adjusts the filter on the analog inputs (TB-5
						and TB-25) to reduce the effect of signal noise
						 The PTO2 delay unite will affect the response time of diagnostic parameters (P520-P523)
P 163	TB-25 (4-20mA)	0	0 No Actio	on		 Selects the reaction to a loss of the 4-20 mA
, ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	Analog Input		1 If TB25	< P164 - Trin F	ault F Enl	signal at TB-25.
	Monitoring Action		2 If TB25	< P164 - Run F	Preset #7	Signal is considered lost if it falls below the
			3 If TB25	< P164 - Run Pi	reset Sea #15	value set in P164
			4 If TB25	> P164 - Trin F	ault F Fol	mA signal: see P140 P142
			5 If TB25	> P164 - Run P	Preset #7	• For P163 = 3 or 6, the accel/decel time is
			6 If TB25	\geq P164 - Run Pi	reset Seg. #15	set in P781. NOTE: P163 has priority over TB-13 presets/auto
						references (P121-P124)

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Code		Possible	Settings			IMPOPTANT
No.	Name	Default	Selection			IMPORTANT
P 164	TB-25 (4-20mA) Analog Input Monitoring Level	2.0	0.0	{mA}	20.0	
P 165	Base Voltage		15	{V}	1000	Valid for V/Hz mode only. Set voltage for bus compensation in V/Hz mode
P 166	Carrier Frequency	See Notes	0 4 kHz 1 6 kHz 2 8 kHz 3 10 kHz			 As carrier frequency is increased, motor noise is decreased Observe derating in section 2.3 Automatic shift to 4 KHz at 120% load NEMA 4X (IP65) Models: Default = 0 (4kHz) NEMA 1 (IP31) Models: Default = 1 (6kHz)
P 167")	Base Frequency	60.0	10.0	{Hz}	1500	
P 168	Fixed Boost		0.0 NOTE	{%}	40.0	P166 0 0 0 0 P167 V0112
			 P167 = P165, P 	rated motor fre 168 = default s	equency for sta setting depends	ndard applications on drive rating
P 169	Accel Boost	0.0	0.0	{%}	20.0	Accel Boost is only active during acceleration
ם ח פ	Slip Compensation	0.0	0.0	{%}	40.0	Increase P170 until the motor speed no longer changes between no load and full load conditions.
Р П I ⁽¹⁾	Current Limit	Max I	30	{%}	Max I	 When the limit is reached, the drive displays <i>EL</i> (Current Limit), and either the acceleration time increases or the output frequency decreases. Digital outputs can also indicate when the limit is reached; see P140, P142. Refer to section 2.3 for the maximum output current Max I (%)
P N2	Current Limit Reduction	0	 Current Normal Current respons Current Normal Current Fast res 	t Limit Reduc response Limit Reductio e Limit Reducti response Limit Reducti ponse	tion Active - n Active - Fast on Disabled - on Disabled -	In field weakening, the Current Limit is inversely proportional to the speed.
Р ПЭ	Decel Override Time	2.0	0.0	{S}	60.0	Maximum time before drive trips into HF fault.
Р ПЧ	DC Brake Voltage	0.0	0.0	{%}	50.0	Setting is a percent of the nominal DC bus voltage.

(1) Any changes to this parameter will not take effect until the drive is stopped.

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Code		Possible	Settings			IMDODTANT
No.	Name	Default	Selection			IMPORIANI
P NS	DC Brake Time	0.0	0.0	{S}	999.9	
		i	NOTE: CONF DC Brake volta If P111=1 or fault cou If P110=2 If P121f applied un	IRM MOTOR ge (P174) is a , 3 and P175 ndition occurs , 46 and P P124=18 and til the TB-13	SUITABILITY Fi pplied for the t =999.9 the brass s. 175=999.9, bu the correspor input is OPEN	DR USE WITH DC BRAKING ime specified by P175 with the following exceptions ake voltage will be applied continuously until a rur rake voltage will be applied for 15s ding TB-13 input is CLOSED, brake voltage will be ED or a fault condition occurs.
P 116	Keypad Setpoint Single Press Increment	0.1	0.1		100.0	Used for run screen setpoint editing only. If P176 >0.1 then scrolling of keypad setpoint is disabled.
P רח Ø	Speed Units	0	0 Hz 1 RPM 2 % 3 /UNITS 4 NONE			Select the UNITS LED that will be illuminated wher the drive is running in speed control mode. For this parameter to be used, P178 must be set to a value other than 0. IF P178 is set to 0, the Hz LED wil be illuminated regardless of the value set in P177
P פרו	Display Frequency Multiplier	0.00	0.00		650.00	 Allows frequency display to be scaled P178 = 0.00: Scaling disabled P178 > 0.00: Display = Actual Frequency X P178
		i	EXAMPLE If P178 = 29.1	7 and actual	frequency = 6	60 Hz, then Drive displays 1750 (rpm)
P 119	Run Screen Display	0	0 {Paramete	er Number}	599	 0 = Normal Run Screen, this display depends on mode of operation. Refer to section 4.2. Other selections choose a diagnostic parameter to display (P501P599). Parameters P560 - P564 are selectable if the sequencer is enabled (P700 is not 0) P560-P564 are not visible until P700 is enabled.
P 180	Oscillation Damping Control	0	0		80	0 = Damping disabled Compensation for resonances within drive
P 18 I	Skip frequency 1	0.0	0.0	{Hz}	500	Drive will not run in the defined skip range
P 182	Skip frequency 2	0.0	0.0	{Hz}	500	used to skip over frequencies that cause
P 184	Skip frequency bandwidth	0.0	0.0	{Hz}	10.0	 P181 and P182 define the start of the skip ranges P184 > 0 defines the bandwidth of both ranges
		i	NOTE Bandwidth (Hz EXAMPLE: P18	z) = f _s (Hz) + I 31 = 18 Hz ar	P184 (Hz) nd P184 = 4 H	f _s = P181 or P182 Iz; skip range is from 18 to 22 Hz
P 185	Voltage Midpoint V/Hz characteristic	0	0.0	{V}	P165	Valid only when P300 = 0 or 2. Use with P187 to define midpoint on V/Hz curve.
P 187 Ø	Frequency Midpoint V/Hz characteristic	0.0	0.0	{Hz}	P167	Valid only when P300 = 0 or 2. Use with P185 to define midpoint on V/Hz curve.
P 189 (9)	Integrated Dynamic Brake		0 Disabled 1 Enabled			

(2) Parameter applicable to SMV models 15HP (11kW) and higher.

(3) Parameter applicable to SMV models 40HP (30kW) and higher.



Code		Possible	Settings	IMPODIANT
No.	Name	Default	Selection	IMPORTANT
P 190	Motor Braking		0 Disabled	Flux brake OFF.
			1 Braking with BUS threshold	When drive is in deceleration and $V_{bas} > V_{deceleration freeze}$ (114% of the rated V_{bas}), the flux brake will be turned ON.
			2 Braking always on with deceleration	As long as drive is in deceleration, the flux brake will be ON.
			3 Braking with bus regulator	When drive is in deceleration and $V_{see} > V_{stockerizing trans} (114\%)$ of the rated V_{see}), the motor speed will be increased to reduce the bus voltage. Determined by the value in P191, the speed increment = slip speed * P191(%) / 37.
			4 Special	(Consult factory before using)
			WARNING Flux braking can cause heat in the motor. protect the motor. If the flux brake is used	To avoid damage to the motor, use a PTC to do frequently, the drive will trip fault "F_PF".
P 19 I	Motor Brake Level	0	0 {%} 75 (flux braking disabled)	Active when P190 > 0 and drive is in deceleration mode. Use to reduce deceleration time on high inertia loads. NOTE: Over usage of P190 can cause frequent 'overload' trips "F.PF" Not active for P300 = 5 (Torque mode)
P 192	Motor Braking Deceleration Reduction Level	0.0	0 P167 (base freq) Raising the value of P191 reduces the drive deceleration rate during flux braking.	Active when $P190 > 0$ and $P192 > 0.0$, Drive is in deceleration mode. Use to reduce deceleration time on high inertia loads. NOTE: Usage of P192 can cause the drive to decelerate faster than settings in P105/P127.
				Not active for P300 = 5 (Torque mode)
P 194	Password	0	0000 9999	 Must enter password to access parameters P194 = 0000: Disables password
P 197	Clear Fault History	0	0 No Action	
			1 Clear Fault History	
P 199	Program Selection		0 Operate from User settings	
			1 Operate from OEM settings	Refer to Notes 1, 2 and 3
			2 Reset to OEM default settings	Refer to Note 1
			 3 Reset to 60 Hz default settings 4 Reset to 50 Hz default settings 	 Refer to Note 4 Parameters are reset to the defaults listed in this manual. For P199=4, the following exceptions apply: P103, P152, P161, P167 = 50.0 Hz P165 = 400V (400/480V drives only) P304 = 50 Hz P305 = 1450 RPM P107 = 0 (480 V drives only)
			5 Translate	Refer to Note 5
		1 Î	WARNING! Modification of P199 can affect drive func be disabled! Check P100 and P121P12: NOTE 1 If the EPM does not contain valid OEM se is set to 1 or 2. NOTE 2 When P199 is set to 1, the drive operates and no other parameters can be changed NOTE 3	tionality! STOP and EXTERNAL FAULT circuitry may 4 ttings, a flashing <i>GF</i> will be displayed when P199 5 from the OEM settings stored in the EPM Module (<i>GE</i> will be displayed if attempted).
			Auto Calibration is not possible when ope NOTES 4 and 5 - on next page.	rating from OEM Settings.



Code		Possible	Settings	IMPORTANT	
No.	Name	Default	Selection	IMPORTANT	
P 199	Program Selection	i	NOTE 4 Resetting to 50 and 60 Hz default setting P120 may need to be reset for the digital i if P120 and the Assertion switch are not s NOTE 5 If an EPM that contains data from a previo • The drive will operate according to the (cE will be displayed if attempted) • To update the EPM to the current softw be changed but the EPM is incompatil	s will set the Assertion Level (P120) to "2" (High). nput devices being used. An $F_{-}RL$ fault may occur set identically. bus compatible software version is installed: previous data, but parameters cannot be changed rare version, set P199 = 5. The parameters can now ble with previous software revisions.	

4.5.4 PID Parameters

Code		Possible	Settings	IMPODIANT		
No.	Name	Default	Selection	IMPORTANT		
P200	PID Mode	0	0 Disabled	Normal-acting: As feedback increases, motor		
			1 Normal-acting	speed decreases		
			2 Reverse-acting	 Reverse-acting: As reedback increases, motor speed increases 		
			3 Normal-acting, Bi-directional	 PID mode is disabled in Vector Torque mode 		
			4 Reverse-acting, Bi-directional	(P300 = 5)		
				• Selections 3, 4: If P112=1, PID controller output		
			NOTE	sets the speed, (range -max freq to +max freq)		
		İ	 NU1E To activate PID mode, one of the TB-13 inputs (P121P124) must be used to sel Auto Reference that matches the desired PID setpoint reference. If the selected PID setpoint reference uses the same analog signal as the PID feedback (P201), an <i>F_I L</i> fault wil Example: The desired PID setpoint reference is the keypad (▲ and ♥). Set TB-1 (Auto Reference: Keypad): TB-13x = closed: PID mode is active TB-13x = open: PID mode is disabled and the drive speed will be controlled reference selected in P101. 			
P20 I	PID Feedback Source	0	0 4-20 mA (TB-25)	Must be set to match the PID feedback signal		
			1 0-10 VDC (TB-5)			
			2 Drive Load (P507)	-		
			3 Feedback from Network			
P202	PID Decimal Point	1	0 PID Display = XXXX	Applies to P204, P205, P214, P215, P231P233,		
			1 PID Display = XXX.X	P242, P522, P523		
			2 PID Display = XX.XX	-		
			3 PID Display = X.XXX			
			4 PID Display = .XXXX			
P203 @	PID Units	0	0 %	Select the UNITS LED that will be illuminated when		
			1 /UNITS	the drive is running in PID control mode		
			2 AMPS	-		
			3 NONE			
P204	Feedback at Minimum Signal	0.0	-99.9 3100.0	Set to match the range of the feedback signal being used		
P205	Feedback at Maximum Signal	100.0	-99.9 3100.0	Example: Feedback signal is 0 - 300 PSI; P204 = 0.0, P205 = 300.0		

(2) Parameter applicable to SMV models 15HP (11kW) and higher.



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ON	

Code		Possible	Settings						
No.	Name	Default	Selection				IMPORTANT		
רסכא	Proportional Gain	5.0	0.0	{%}	1000.0	Use	ed to tune the PID loop:		
P208	Integral Gain	0.0	0.0	{S}	20.0	•	Increase P207 until system becomes unstable,		
P209	Derivative Gain	0.0	0.0	{S}	20.0	•	Next, increase P208 until feedback matches		
							setpoint If required, increase P209 to compensate for		
							sudden changes in feedback		
		i	NOTE •	Derivative Gai	n is very sens	sitive	e to noise on the feedback signal. Use with care.		
	DID Cotraint Down	00.0	•	Derivative Gai	n is not norn	naiiy	required in pump and fan applications		
P2 10	PID Selpoint Ramp	20.0	0.0	{S}	100.0	•	or vice versa.		
						•	Used to smooth the transition from one PID setpoint to another, such as when using the Preset PID Setpoints (P231P233)		
P2 14	Minimum Alarm	0.0	P204		P205	Use	e with P140, P142 = 1823		
P2 15	Maximum Alarm	0.0	P204		P205				
P23 I	Preset PID Setpoint #1	0.0	P204		P205	ТB-	13A activated; P121 = 3 and P200 = 1 or 2		
P232	Preset PID Setpoint #2	0.0	P204		P205	TB-	-13B activated; $P122 = 3$ and $P200 = 1$ or 2		
P233	Preset PID Setpoint #3	0.0	P204		P205	ТB-	13C activated; P123 = 3 and P200 = 1 or 2		
P234@	Preset PID Setpoint #4	0.0	P204		P205	ТB-	13D activated; P124 = 3 and P200 = 1 or 2		
P240	Sleep Threshold	0.0	0.0	{Hz}	500.0	•	If drive speed $<$ P240 for longer than P241,		
P24 I	Sleep Delay	30.0	0.0	{S}	300.0		output frequency = 0.0 Hz ; drive display = 5LP		
P242	Sleep Bandwidth	0.0	0.0		B _{max}		P240 = 0.0: Sleep mode is disabled. P200 = 02: Drive will start again when speed		
			Whore D	(DOOF DOOA)	1	command is above P240			
			where $D_{max} = 0$	(P200 - P204)	I	•	 P242 > 0.0: Drive will restart when the PIC feedback differe from the astroint by married. 		
						the the value of P242 or when the PID loo			
							requires a speed above P240.		
P243	Feedback Sleep Entry Threshold	0.0	P204		P205	Act	ive only when $P244 = 1$ or 2		
P244	Sleep Entry Mode	0	0 Enter SLEEF	P if Drive Spee	ed <p240< td=""><td>For</td><td>time longer than P241</td></p240<>	For	time longer than P241		
			1 Enter SLEE	P if Feedback	>P243	For	time longer than P241 or same as Sel 0		
	a) <u> </u>		2 Enter SLEEF	P if Feedback	<p243< th=""><th>For</th><th>time longer than P241 or same as Sel 0</th></p243<>	For	time longer than P241 or same as Sel 0		
P245	Sleep Entry Stop	0	0 Coast to Sto	ор					
	Туре		1 Ramp to St	op 111.oottingo					
0345	Feedback Becovery	0.0		TTT Settings	P205	Act	ive only when P247 – 1 or 2		
P240	from Sleep Threshold	0.0	F204		F203	ACI	We only when $r_2 4 r = 1$ of 2		
P247	Sleep Recovery Mode	0	0 Recovery if or if PID feed by more that	Speed Setpoi dback differs f an P242	nt > P240 rom setpoint				
			1 Recovery or	nly if Feedbac	k < P246				
			2 Recovery or	nly if Feedbac	k > P246				

(2) Parameter applicable to SMV models 15HP (11kW) and higher.



Code		Possible Settings					
No.	Name	Default	Selection			IMPORTANT	
P250	Auto Rinse in Sleep Mode	0	0 Disabled 1 Enabled			Activated in sleep mode only. Sleep Recovery cancels Auto Rinse	
P25 I	Time Delay between Auto Rinses	30.0	0.0	{min}	6553.5	Time delay reset by re/entering sleep mode	
P252	Auto Rinse Speed	0.0	-500.0	{Hz}	500.0	If $P112 = 1$, negative sign = reverse direction	
P253	Auto Rinse Time	0.0	0.0	{sec}	6553.5	Does not include time to decel back to speed	
			Auto Pump Ri P250=1 (Enal P251=# m PumpRinse P252=Hz spe P253=# seco	inse Setup: bled) inutes be ed of Pump nds Pump F	etween each Rinse linse duration	Pump Rinse Speed P252 P104/ Delay Time Petroven each Pump Rinse Time Ping Rinse Pump Rinse Street Ping Rinse Speed P105/ P105	
P280	Current Level: Flying Restart Type 2	70.0	0.0	{%}	P171	Maximum current during Type 2 flying restart operation	
P28 I	Decel Time: Flying Restart Type 2	3.0	0.0	{sec}	3600.0	Deceleration rate used during Type 2 flying restart operation	

4.5.5 Vector Parameters

Code		Possible	Settings	IMDODTANT
No.	Name	Default	Selection	IMPORTANT
P300 (1)	Drive Mode	0	0 Constant V/Hz	Constant torque V/Hz control for general applications
			1 Variable V/Hz	Variable torque V/Hz control for centrifugal pump and fan applications
			2 Enhanced Constant V/Hz	For single or multiple motor applications that require
			3 Enhanced Variable V/Hz	better performance than settings 0 or 1, but cannot use Vector mode, due to: • Missing required motor data • Vector mode serving upstable motor operation
			4 Vector Speed	For single-motor applications requiring higher starting torque and speed regulation
			5 Vector Torque	For single-motor applications requiring torque control independent of speed
		i	NOTE To configure the drive for either Vector P 300 = 4, 5: - Set P302P306 according to mot - Set P399 = 1 or 2 (if option 1 fail - Make sure motor is cold (20° - 22 - Display will indicate CFL for about - Once the calibration is complete, command to actually start the motor. - If an attempt is made to start the performing the Motor Calibration, P 9300 = 2, 3: Same as above but other to start the tother to the start the tother Calibration,	mode or Enhanced V/Hz mode: tor nameplate ad or in case of non-standard motor) 5° C) and apply a Start command it 40 seconds the display will indicate 5LoP ; apply another Start tor he drive in Vector or Enhanced V/Hz mode before the drive will display F_n Id and will not operate nly need to set P302P304
P302 (1)	Motor Rated Voltage		0 {V} 600	Default setting = drive rating Set to metan nemericate data
P303 (1)	Motor Rated Current		0.1 {A} 500.0	 Set to motor namepiate data

(1) Any changes to this parameter will not take effect until the drive is stopped.



Code		Possible	Settings			IMPOPTANT	
No.	Name	Default	Selection			INFORTANT	
P304 ⁽¹⁾	Motor Rated Frequency	60	0	{Hz}	1000		
P305 (1)	Motor Rated Speed	1750	300	{RPM}	65000	Set to motor nameplate data	
P306 (1)	Motor Cosine Phi	0.80	0.40		0.99		
		i	NOTE If mo cos phi = moto cos phi = cos	tor cosine phi or Watts / (mot [sin ⁻¹ (magneti	is not kno or efficien izing curre	vn, use one of the following formulas: cy X P302 X P303 X 1.732) nt / motor current) 1	
P3 10 (1)	Motor Stator Resistance		0.00	{Ω}	64.00	 P310, 311 default setting depends on drive rating Will be automatically programmed by P399 	
P3 ⁽¹⁾	Motor Stator Inductance		0.0	{mH}	2000	 Changing these settings can adversely affect performance. Contact factory technical support prior to changing 	
P3 15	Dead Time Compensation Factor	0.0	-50.0	{%}	+50.0	 Adjust dead time correction from internal default Takes effect when P399 = 3. 	
P330	Torque Limit	100	0	{%}	400	When $P300 = 5$, sets the maximum output torque.	
P33 I	Preset Torque Setpoint #1	100	0	{%}	400	TB-13A activated; P121 = 3 and P300 = 5	
P332	Preset Torque Setpoint #2	100	0	{%}	400	TB-13B activated; P122 = 3 and P300 = 5	
P333	Preset Torque Setpoint #3	100	0	{%}	400	TB-13C activated; $P123 = 3$ and $P300 = 5$	
P334 ⁽²⁾	Preset Torque Setpoint #4	100	0	{%}	400	TB-13D activated; P124 = 3 and P300 = 5	
P340 (1)	Current Loop P Gain	0.25	0.00		16.0	Changing these settings can adversely affect	
P34 I ⁽¹⁾	Current Loop I Gain	65	12	{ms}	9990	performance. Contact factory technical support prior to changing.	
P342 (1)	Speed Loop Adjust	0.0	0.0	{%}	20.0		
P343	Slip Compensation Response Filter	99	90	{ms}	9999	Low pass filter time constant for varying the slip compensation response to changes in the motor current.	
P399	Motor Auto- calibration	0	Calibration Not Done Standard Calibration Enabled Advanced Calibration Enabled Bypass Calibration, enable operation in vector mode w/o Auto Calibration Standard Calibration Complete Advanced Calibration Complete			 If P300 = 4 or 5, motor calibration must be performed if P399 is not set to 3 (bypass calibration). If P300-2 or 3, motor calibration is recommended. Use option 2 if option 1 failed or in case of non-standard motors An alternating <i>CRL / Err</i> will occur if: attempt motor calibration with P300 = 0 or 1 motor calibration is attempted before programming motor data 	
		i	– Set – Set – Ma – App – Dis – Ono Sta	P302P306 a P399 = 1 or 2 ke sure motor bly a Start com play will indica ce the calibrati rt command to ameter P399 v	according (if option is cold (20 mand te CAL fo ion is com o actually s vill now be	to motor nameplate 1 failed or in case of non-standard motor) 3° - 25° C) r about 40 seconds uplete, the display will indicate 5LoP ; apply another start the motor e set to 4 or 5.	

(1) Any changes to this parameter will not take effect until the drive is stopped.

(2) Parameter applicable to SMV models 15HP (11kW) and higher.



4.5.6 Network Parameters

Code		Possible	Settings	IMPORTANT	
No.	No. Name Default		Selection		
P400	Network Protocol		0 Not Active	This parameter setting is based upon the network	
			1 Remote Keypad	or I/O module that is installed.	
			2 Modbus RTU		
			3 CANopen		
			4 DeviceNet		
			5 Ethernet		
			6 Profibus		
			7 Lecom-B		
			8 I/O Module		
P40 I	Module Type Installed	0	0 No Module Installed	Module type format: 0xAABC; Drive Display:	
			1 Basic I/O (0x0100, 1.0.0)	AA.B.C	
			2 RS485/Rem. Keypad (0x0200, 2.0.0)	AA = Module Type	
			3 CANopen (0x0300, 3.0.0)	B = Major revision	
			11 PROFIBUS (0x1100, 11.0.0)	C = minor revision	
			12 Ethernet (0x1200, 12.0.0)		
P402	Module Status	0	0 Not Initialized		
			1 Initialization: Module to EPM		
			2 Initialization: EPM to Module		
			3 Online		
			4 Failed Initialization Error		
			5 Time-out Error		
			6 Initialization Failed	Module type mismatch P401	
			7 Initialization Error	Protocol selection mismatch P400	
P403	Module Reset	0	0 No Action	Returns module parameters 401499 to the	
			1 Reset parameters to default values	default values shown in the manual	
P4D4	Module Timeout Action	3	0 No Fault	Action to be taken in the event of a Module/	
			1 STOP (see P111)	Drive Time-out.	
			2 Quick Stop	Time is fixed at 200ms	
			3 Fault (F_ntF)	STOP is by the method selected in P111.	
P405	Current Network Fault		0 No Fault		
			1 F.nF1	Netidle Mode	
			2 F.nF2	Loss of Ethernet I/O connection	
			3 F.nF3	Network Fault	
			4 F.nF4	Explicit Message Timeout	
			5 F.nF5	Overall Network Timeout	
			6 F.nF6	Overall Explicit Timeout	
			7 F.nF7	Overall I/O Message Timeout	
P406	Proprietary			Manufacturer specific	
0.07	0.00	Madule		Refer to the Communications Reference Guide	
P407 P499		Module Specific Parameters		specific to the network or I/O module installed.	





4.5.7 **Diagnostic Parameters**

Code		Dienlay Band		ΙΜΡΟΒΤΔΝΤ		
No.	Name		e (nead une t)	IMFORTANT		
P500	Fault History			 Displays the last 8 faults Format: n.xxx where: n = 18, 1 is the newest fault; xxx = fault message (w/o the <i>F</i>.) Refer to section 5.3 		
P50 I	Software Version			Format: x.yz		
P502	Drive ID			A flashing display indicates that the Drive ID stored in the EPM does not match the drive model it is plugged into.		
P503	Internal Code			Alternating Display: xxx-; -yy		
P505	DC Bus Voltage	0 {VE	DC} 1500			
P506	Motor Voltage	0 {VA	AC} 1000			
רס59	Load	0 {%	} 255	Motor load as % of drive's output current rating. Refer to section 2.3.		
P508	Motor Current	0.0 {A}	1000	Actual motor current		
P509	Torque	0 {%	} 500	Torque as % of motor rated torque (vector mode only)		
P5 10	Output Power kW	0.00 {kV	V} 650.0			
P5 I I	Total kWh	0.0 {kV	Vh} 9999999	Alternating display: xxx-; yyyy when value exceeds 9999		
P5 12	Heatsink Temp	0 {°C	\$ 150	Heatsink temperature		
P520	0-10 VDC Input	0.0 {VE	DC} 10.0	Actual value of signal at TB-5 (See P162)		
P52 I	4-20 mA Input	0.0 {m	A} 20.0	Actual value of signal at TB-25 (See P162)		
P522	TB-5 Feedback	P204	P205	TB-5 signal value scaled to PID feedback units (See P162)		
P523	TB-25 Feedback	P204	P205	TB-25 signal value scaled to PID feedback units (See P162)		
P524	Network Feedback	P204	P205	Network signal value scaled to PID feedback units		
P525	Analog Output	0 {VE	DC} 10.0	Refer to P150P155		
P527	Actual Output Frequency	0 {Hz	2} 500.0			
P528	Network Speed Command	0 {Hz	2} 500.0	Command speed if (Auto: Network) is selected as the speed source		
P530	Terminal and Protection Status			Indicates terminal status using segments of the LED display. (Refer to section 4.5.7.1)		
P53 I	Keypad Status			Indicates keypad button status using segments of the LED display. (Refer to section 4.5.7.2)		
P540	Total Run Time	0 {h}	99999999	Alternating display: xxx-; yyyy when value exceeds 9999		
P54 I	Total Power On Time	0 {h}	9999999			
P550	Fault History	1	8	 Displays the last 8 faults Format: n.xxx where: n = 18, 1 is the newest fault; xxx = fault message (w/o the <i>F</i>.) Refer to section 5.3 		
P55 I	Fault History Time	0 {h}	999999	Display: "n.hh-" "hhhh" "mm.ss" = fault #, hours, seconds The "hhhh" screen is displayed after hours exceed 999.		
P552	Fault History Counter	0	255	Number of sequential occurrences of a fault. For example: 3 external faults occur over a period of time with no other errors occurring. Then P552 will indicate 3, P550 will indicate the error EF and P551 will indicate the time of the first fault occurrence.		



Code		Display Dange (DEAD ONL)			IMPORTANT		
No.	Name		Jispiay Range (REAL	D UNLT)	IMPORTANT		
P560	Sequencer: Currently Active Segment	0		17			
P56 I	Sequencer: Time since Start of Active Segment	0.0 0	{P708} {P708}	6553.5 65535	Unit depends on P708 (0.1sec, sec or minutes)		
P562	Sequencer: Time Remaining in Active Segment	0.0 0	{P708} {P708}	6553.5 65535	Unit depends on P708 (0.1sec, sec or minutes)		
P563	Sequencer: Number of cycles since start	0		65535			
P564	Sequencer: Number of cycles remaining	0		65535			
		NOTE: Parameters P560-P564 are visible only when P700 > 0 (i.e. the sequencer is enabled)					

4.5.7.1 Terminal & Protection Status Display

Parameter P530 allows monitoring of the control terminal points and common drive conditions:

An illuminated LED segment indicates:

- the protective circuit is active (LED 1)
- the Logic Assertion Switch is set to High (+)
- input terminal is asserted (LED 2)
- output terminal is energized (LED 4)
- the Charge Relay is not a terminal, this segment will be illuminated when the Charge Relay is energized (LED 4).



* Input 13D available on 15-60HP (11-45kW) models only

4.5.7.2 Keypad Status Display

Parameter P531 allows monitoring of the keypad pushbuttons: An illuminated LED segment indicates when the button is depressed.

LED 1 and LED 2 are used to indicate pushbutton presses on a remote keypad that is attached to the drive. LED 3 and LED 4 indicate button presses on the local drive keypad.





Onboard Communications Parameters 15-60HP (11-45kW)

Commissioning

The P6xx Onboard Communication parameters are applicable to the 15HP (11kW) and higher models only.

4.5.8

Code		Possible	Settings	IMPOPTANT
No.	Name	Default	Selection	IMPORTANT
P600	Network Enable	0	0 Disabled	This parameter enables the onboard network
			1 Remote Keypad	communications.
			2 Modbus	
			7 Lecom	
		•	NOTE: Onboard Communications will be	
			disabled if:	If the onboard communications are disabled.
			-P600 = 0, 0r P600 = 1 and P400 = 1 or	the user will not have access to any of the other
			-P600 = 2 and $P400 = 2, 3, 4, 5, 6$ or 7	P6xx parameters.
			-P600 = 7 and $P400 = 2, 3, 4, 5, 6$ or 7	
P6 10	Network Address	1	1 - 247	Modbus
		1	1 - 99	Lecom
P6 1 1	Network Baud Rate	2	0 2400 bps 2 9600 bps	Modbus
			1 4800 bps 3 19200 bps	
		0	0 9600 bps	Lecom
			1 4800 bps	
			2 2400 bps	
			3 1200 bps	
			4 19200 bps	
P6 12	Network Data Format	0	0 8, N, 2	Modbus Only
			1 8, N, 1	
			2 8, E, 1	
			3 8, 0, 1	
P620	Network Control	0	0 Monitor Only	Lecom Only
	Level		1 Parameter Programming	
			2 Programming and Setpoint Control	
			3 Full Control	
P624	Network Powerup	0	0 Quick Stop	Lecom Only
	Start Status		1 Controller Inhibit	
P625	Network Timeout	10.0	0.0 - 300.0 seconds	Modbus
		50	0 - 65000 milliseconds	Lecom
P626	Network Timeout	4	0 No action	Modbus
	Action		1 Stop (P111)	
			2 Quick Stop	
			3 Controller Inhibit	
			4 Trip Fault, F.nF1	
		0	0 No action	Lecom
			1 Controller Inhibit	
			2 Quick Stop	
L			3 Trip Fault, F.nF1	
P627	Network Messages		Read-Only: 0 - 9999	Valid network messages received
	Received	i	NOTE: When the number of messages (counting from 0.	exceeds 9999, the counter resets and resumes



4.5.9 Sequencer Parameters

The P700 Sequencer parameters are listed herein. Refer to section 4.5.7 for P56x Sequencer Diagnostic Parameters. The sequencer function consists of 16 step segments, each individual step segment can have its own ramp time, time spent in individual segment and output frequency entered. The sequencer has 3 different modes to control how the drive moves through each individual step segment: Timer Transition, Step Sequence or Timer and Step Sequence.

P700= 1 (Timer Transition)

Starting at the segment number entered in the "Start Segment" parameter, the drive will automatically move through each of the segments. The time spent in each segment is determined by the values set in the individual "Time in Current Step" parameters.

P700= 2 (Step Sequence)

Starting at the segment number entered in the "Start Segment" parameter the sequencer will only move to the next segment when a rising edge is applied to the highest priority digital input which is programmed to "Step Sequence" selection "24".

P700= 3 (Timer Transition or Step Sequence)

Starting at the segment number entered in the "Start Segment" parameter, the drive will automatically move through each of the segments. The time spent in each segment is determined by the values set in the individual "Time in Current Step" parameters, however if a rising edge is applied to the highest priority digital input which is programmed to "Step Sequence" selection "24" it will force the sequencer to step into the next segment.

NOTE: A value of "0" in the "Time in current step" parameter (ex: P712), will result in the segment being skipped.

Code		Possible	Settings	IMPOPTANT
No.	Name	Default	Selection	
ססרק	Sequencer Mode	0	0 Disabled	If $P700 = 0$ and no reference (P121, P101)
			1 Enabled: transition on timer only	points to any of the sequence segments,
			$ \begin{array}{llllllllllllllllllllllllllllllllllll$	local keypad.
			3 Enabled: transition on timer or rising edge	
ו סרק	Sequencer: TB13A Trigger Segment	1	1 - 16 TB13A = lowest priority	Asserting TB13A with selection #24 (Start Sequence), starts the sequence operation from the segment specified in this parameter.
902 5019	Sequencer: TB13B Trigger Segment	1	1 - 16 TB13B: higher priority than TB13A	Asserting TB13B with selection #24 (Start Sequence), starts the sequence operation from the segment specified in this parameter.
80 FT	Sequencer: TB13C Trigger Segment	1	1 - 16 TB13C: higher priority thanTB13B, A	Asserting TB13C with selection #24 (Start Sequence), starts the sequence operation from the segment specified in this parameter.
P704 ⁽²⁾	Sequencer: TB13D Trigger Segment	1	1 - 16 TB13D: higher priority than TB13C, B, A	Asserting TB13D with selection #24 (Start Sequence), starts the sequence operation from the segment specified in this parameter.
P706	Sequencer: Action	0	0 Restart at beginning of sequence	Pointed by TB13x
	after Stop/Start		1 Restart at beginning of current seg	
	Restart 2 Start at beginning of prior segment		2 Start at beginning of prior segment	
			3 Start at beginning of next segment	
רסרק	Sequencer: Number of cycles	1	1 65535	1 = single scan; 65535 = continuous loop

(2) Parameter applicable to SMV models 15HP (11kW) and higher.



Code		Possible	e Settings			
No.	Name	Default	Selection			IMPORTANT
P708	Sequencer: Time	0	0 0.1	{sec}	6553.5	Setup units/scaling for all sequencer time
	units/scaling		1 1	{sec}	65535	related parameters
			2 1	{min}	65535	
		i	NOTE: P708 rescales t - Segmen P752, P - Sequen	the following s Int Times in cu 757, P762, P ce diagnostic	sequencer relat rrent step: P71 767, P772, P77 /status: P561, F	ted parameters: 2, P717, P722, P727, P732, P737, P742, P747, 7, P782, P787, P792 2562
	Segment #1					
םו ריי	Segment #1 Frequency Setpoint	0.0	-500.0	{Hz}	500.0	If $P112 = 1$, negative sign forces reverse direction
וורי	Segment #1 Accel/Decel Time	20.0	0.0	{sec}	3600.0	
21 רק	Segment #1 Time in current step	0.0 0	0.0 0	{P708} {P708}	6553.5 65535	Scaling/units depend on P708 Skip segment if time = 0
פו רק	Segment #1 Digital Output State	0	Value set in P713 Relay (Bit 0) TB14 (Bit 1) I/O option Relay (Bit 2 NOTE: P441 is the F optional Digital I/O m	0 1 2 3 0 1 0 1 0 0 1 1 2) 0 0 0 0 Relay Output (TB-nodule (ESVZALO, 1000000000000000000000000000000000000	4 5 6 7 0 1 0 1 0 0 1 1 1 1 1 1 19, 20, 21) of the ESVZAL1). ESVZAL1).	bit = 0: OFF (De-energized) bit = 1: 0N (Energized) The corresponding digital output/relay must be set to accept data from the sequencer: P140, P142, P441 = 27
P7 14	Segment #1 TB30 Analog Output Value	0.00	0.00	{VDC}	10.00	TB30 configuration parameter must be set to accept this value: $P150 = 10$
	Segment #2					
P7 IS	Segment #2 Frequency Setpoint	0.0	-500.0	{Hz}	500.0	If $P112 = 1$, negative sign forces reverse direction
P7 16	Segment #2 Accel/Decel Time	20.0	0.0	{sec}	3600.0	
ח רק	Segment #2 Time in current step	0.0 0	0.0 0	{P708} {P708}	6553.5 65535	Scaling/units depend on P708 Skip segment if time $= 0$
P7 18	Segment #2 Digital Output State	0	Value set in P718 Relay (Bit 0) TB14 (Bit 1) I/O option Relay (Bit 2 NOTE: P441 is the P optional Digital I/O n	0 1 2 3 0 1 0 1 0 0 1 1 2) 0 0 0 0 Relay Output (TB-module (ESVZALO)) 1 1 1	4 5 6 7 0 1 0 1 0 0 1 1 1 1 1 1 19, 20, 21) of the ESVZAL1). ESVZAL1).	bit = 0: OFF (De-energized) bit = 1: ON (Energized) The corresponding digital output/relay must be set to accept data from the sequencer: P140, P142, P441 = 27
פו רק	Segment #2 TB30 Analog Output Value	0.00	0.00	{VDC}	10.00	TB30 configuration parameter must be set to accept this value: $P150 = 10$



Code		Possible	Settings			INDODTANT
No.	Name	Default	Selection			IMPORTANT
	Segment #3					
03C9	Segment #3 Frequency Setpoint	0.0	-500.0	{Hz}	500.0	If $P112 = 1$, negative sign forces reverse direction
ו 5רק	Segment #3 Accel/Decel Time	20.0	0.0	{sec}	3600.0	
P722	Segment #3 Time in current step	0.0 0	0.0 0	{P708} {P708}	6553.5 65535	Scaling/units depend on P708 Skip segment if time = 0
P723	Segment #3 Digital Output State	0	Value set in P723 Relay (Bit 0) TB14 (Bit 1) I/O option Relay (Bit 2 NOTE: P441 is the F optional Digital I/O n	0 1 2 3 0 1 0 1 0 0 1 1 0 0 1 1 0 0 0 0 0 0 0 0 0 0 0 Relay Output (TB-nodule (ESVZAL0, 0 0 0 0	4 5 6 7 0 1 0 1 0 0 1 1 1 1 1 1 19, 20, 21) of the ESVZAL1). ESVZAL1). ESVZAL1).	bit = 0: OFF (De-energized) bit = 1: 0N (Energized) The corresponding digital output/relay must be set to accept data from the sequencer: P140, P142, P441 = 27
P724	Segment #3 TB30 Analog Output Value	0.00	0.00	{VDC}	10.00	TB30 configuration parameter must be set to accept this value: $P150 = 10$
	Segment #4		·			
P725	Segment #4 Frequency Setpoint	0.0	-500.0	{Hz}	500.0	If $P112 = 1$, negative sign forces reverse direction
P726	Segment #4 Accel/Decel Time	20.0	0.0	{sec}	3600.0	
רברק	Segment #4 Time in current step	0.0 0	0.0 0	{P708} {P708}	6553.5 65535	Scaling/units depend on P708 Skip segment if time $= 0$
P728	Segment #4 Digital Output State	0	Value set in P728 Relay (Bit 0) TB14 (Bit 1) I/O option Relay (Bit 2 NOTE: P441 is the F optional Digital I/O n	0 1 2 3 0 1 0 1 0 0 1 1 0 0 1 1 1 0 0 0 0 1 0 0 0 0 0 Relay Output (TB-nodule (ESVZAL0, 0) 0) 0)	4 5 6 7 0 1 0 1 0 0 1 1 1 1 1 1 19, 20, 21) of the ESVZAL1). ESVZAL1).	bit = 0: OFF (De-energized) bit = 1: ON (Energized) The corresponding digital output/relay must be set to accept data from the sequencer: P140, P142, P441 = 27
P729	Segment #4 TB30 Analog Output Value	0.00	0.00	{VDC}	10.00	TB30 configuration parameter must be set to accept this value: $P150 = 10$
	Segment #5					
0E79	Segment #5 Frequency Setpoint	0.0	-500.0	{Hz}	500.0	If $P112 = 1$, negative sign forces reverse direction
ו ברק	Segment #5 Accel/Decel Time	20.0	0.0	{sec}	3600.0	
9732 SEC9	Segment #5 Time in current step	0.0 0	0.0 0	{P708} {P708}	6553.5 65535	Scaling/units depend on P708 Skip segment if time $= 0$
PT33	Segment #5 Digital Output State	0	Value set in P733 Relay (Bit 0) TB14 (Bit 1) I/O option Relay (Bit 2 NOTE: P441 is the F optional Digital I/O n	0 1 2 3 0 1 0 1 0 0 1 1 0 0 1 1 1 0 0 1 1 1 0 0 0 0 0 1 0 0 0 0 0 0 Relay Output (TB-nodule (ESVZAL0, (TB-nodule (ESVZAL0, (TB-nodule	4 5 6 7 0 1 0 1 0 0 1 1 1 1 1 1 19, 20, 21) of the ESVZAL1). ESVZAL1).	bit = 0: OFF (De-energized) bit = 1: 0N (Energized) The corresponding digital output/relay must be set to accept data from the sequencer: P140, P142, P441 = 27
PT34	Segment #5 TB30 Analog Output Value	0.00	0.00	{VDC}	10.00	TB30 configuration parameter must be set to accept this value: $P150 = 10$



Code		Possible	Settings	Settings		IMPORTANT
No.	Name	Default	Selection			IMPORTANT
	Segment #6					
P735	Segment #6 Frequency Setpoint	0.0	-500.0	{Hz}	500.0	If $P112 = 1$, negative sign forces reverse direction
P736	Segment #6 Accel/Decel Time	20.0	0.0	{sec}	3600.0	
רברק	Segment #6 Time in current step	0.0 0	0.0 0	{P708} {P708}	6553.5 65535	Scaling/units depend on P708 Skip segment if time = 0
P738	Segment #6 Digital Output State	0	Value set in P738 Relay (Bit 0) TB14 (Bit 1) I/O option Relay (Bit 2 NOTE: P441 is the F optional Digital I/O n	0 1 2 3 0 1 0 1 0 0 1 1 0 0 1 1 0 0 0 0 0 0 0 0 0 0 0 Relay Output (TB-nodule (ESVZAL0, 0) 0) 0)	4 5 6 7 0 1 0 1 0 0 1 1 1 1 1 1 19, 20, 21) of the ESVZAL1). ESVZAL1).	bit = 0: OFF (De-energized) bit = 1: ON (Energized) The corresponding digital output/relay must be set to accept data from the sequencer: P140, P142, P441 = 27
P739	Segment #6 TB30 Analog Output Value	0.00	0.00	{VDC}	10.00	TB30 configuration parameter must be set to accept this value: $P150 = 10$
	Segment #7					
РТЧО	Segment #7 Frequency Setpoint	0.0	-500.0	{Hz}	500.0	If $P112 = 1$, negative sign forces reverse direction
ртч і	Segment #7 Accel/Decel Time	20.0	0.0	{sec}	3600.0	
P742	Segment #7 Time in current step	0.0 0	0.0 0	{P708} {P708}	6553.5 65535	Scaling/units depend on P708 Skip segment if time = 0
P743	Segment #7 Digital Output State	0	Value set in P743 Relay (Bit 0) TB14 (Bit 1) I/O option Relay (Bit 2 NOTE: P441 is the P optional Digital I/O m	0 1 2 3 0 1 0 1 0 0 1 1 0 0 1 1 1 0 0 0 0 1 0 0 0 0 0 1 0 0 0 0 0 Relay Output (TB-nodule (ESVZAL0, (TB-nodule (ESVZAL0, (TB-nodule (TB-nod	4 5 6 7 0 1 0 1 0 0 1 1 1 1 1 1 19, 20, 21) of the ESVZAL1). ESVZAL1).	bit = 0: OFF (De-energized) bit = 1: ON (Energized) The corresponding digital output/relay must be set to accept data from the sequencer: P140, P142, P441 = 27
ртчч	Segment #7 TB30 Analog Output Value	0.00	0.00	{VDC}	10.00	TB30 configuration parameter must be set to accept this value: $P150 = 10$
	Segment #8					
P745	Segment #8 Frequency Setpoint	0.0	-500.0	{Hz}	500.0	If $P112 = 1$, negative sign forces reverse direction
Р746	Segment #8 Accel/Decel Time	20.0	0.0	{sec}	3600.0	
РТЧТ	Segment #8 Time in current step	0.0 0	0.0 0	{P708} {P708}	6553.5 65535	Scaling/units depend on P708 Skip segment if time = 0
P748	Segment #8 Digital Output State	0	Value set in P748 Relay (Bit 0) TB14 (Bit 1) I/O option Relay (Bit 2 NOTE: P441 is the P optional Digital I/O n	0 1 2 3 0 1 0 1 0 0 1 1 0 0 1 1 1 0 0 0 0 1 0 0 0 0 0 1 0 0 0 0 0 1 0 0 0 0 0 1 0 0 0 0 0 1 0 0 0 0 0 1 0 0 0 0 0 1 0 0 0 0 0 1 0 0 0 0 0	4 5 6 7 0 1 0 1 0 0 1 1 1 1 1 1 19, 20, 21) of the ESVZAL1). ESVZAL1	bit = 0: OFF (De-energized) bit = 1: ON (Energized) The corresponding digital output/relay must be set to accept data from the sequencer: P140, P142, P441 = 27
P749	Segment #8 TB30 Analog Output Value	0.00	0.00	{VDC}	10.00	TB30 configuration parameter must be set to accept this value: $P150 = 10$

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Code		Possible	Settings			INDODTANT
No.	Name	Default	Selection			IMPORTANT
	Segment #9					
P750	Segment #9 Frequency Setpoint	0.0	-500.0	{Hz}	500.0	If $P112 = 1$, negative sign forces reverse direction
P75 I	Segment #9 Accel/Decel Time	20.0	0.0	{sec}	3600.0	
P152	Segment #9 Time in current step	0.0 0	0.0 0	{P708} {P708}	6553.5 65535	Scaling/units depend on P708 Skip segment if time = 0
P153	Segment #9 Digital Output State	0	Value set in P753 Relay (Bit 0) TB14 (Bit 1) I/O option Relay (Bit 2 NOTE: P441 is the F optional Digital I/O n	0 1 2 3 0 1 0 1 0 0 1 1 0 0 1 1 0 0 0 0 0 0 0 0 0 0 0 Relay Output (TB-nodule (ESVZAL0, 0 0 0 0	4 5 6 7 0 1 0 1 0 0 1 1 1 1 1 1 19, 20, 21) of the ESVZAL1). ESVZAL1).	bit = 0: OFF (De-energized) bit = 1: ON (Energized) The corresponding digital output/relay must be set to accept data from the sequencer: P140, P142, P441 = 27
P754	Segment #9 TB30 Analog Output Value	0.00	0.00	{VDC}	10.00	TB30 configuration parameter must be set to accept this value: $P150 = 10$
	Segment #10					
P755	Segment #10 Frequency Setpoint	0.0	-500.0	{Hz}	500.0	If $P112 = 1$, negative sign forces reverse direction
P756	Segment #10 Accel/Decel Time	20.0	0.0	{sec}	3600.0	
P151	Segment #10 Time in current step	0.0 0	0.0 0	{P708} {P708}	6553.5 65535	Scaling/units depend on P708 Skip segment if time $= 0$
P758	Segment #10 Digital Output State	0	Value set in P758 Relay (Bit 0) TB14 (Bit 1) I/O option Relay (Bit 2 NOTE: P441 is the F optional Digital I/O n	0 1 2 3 0 1 0 1 0 0 1 1 0 0 1 1 1 0 0 0 0 1 0 0 0 0 0 1 0 0 0 0 0 Relay Output (TB-nodule (ESVZAL0, (TB-nodule (ESVZAL0, (TB-nodule (TB-nod	4 5 6 7 0 1 0 1 0 0 1 1 1 1 1 1 19, 20, 21) of the ESVZAL1). ESVZAL1).	bit = 0: OFF (De-energized) bit = 1: ON (Energized) The corresponding digital output/relay must be set to accept data from the sequencer: P140, P142, P441 = 27
P759	Segment #10 TB30 Analog Output Value	0.00	0.00	{VDC}	10.00	TB30 configuration parameter must be set to accept this value: $P150 = 10$
	Segment #11					
P760	Segment #11 Frequency Setpoint	0.0	-500.0	{Hz}	500.0	If $P112 = 1$, negative sign forces reverse direction
P76 I	Segment #11 Accel/Decel Time	20.0	0.0	{sec}	3600.0	
P762	Segment #11 Time in current step	0.0 0	0.0 0	{P708} {P708}	6553.5 65535	Scaling/units depend on P708 Skip segment if time $= 0$
P763	Segment #11 Digital Output State	0	Value set in P763 Relay (Bit 0) TB14 (Bit 1) I/O option Relay (Bit 2 NOTE: P441 is the F optional Digital I/O n	0 1 2 3 0 1 0 1 0 0 1 1 0 0 1 1 1 0 0 1 1 1 0 0 0 0 0 1 0 0 0 0 0 0 Relay Output (TB-nodule (ESVZAL0, (TB-nodule (ESVZAL0, (TB-nodule	4 5 6 7 0 1 0 1 0 0 1 1 1 1 1 1 19, 20, 21) of the ESVZAL1). ESVZAL1).	bit = 0: OFF (De-energized) bit = 1: 0N (Energized) The corresponding digital output/relay must be set to accept data from the sequencer: P140, P142, P441 = 27
РТБЧ	Segment #11 TB30 Analog Output Value	0.00	0.00	{VDC}	10.00	TB30 configuration parameter must be set to accept this value: $P150 = 10$



Code		Possible	Settings		IMPORTANT			
No.	Name	Default	Selection			IMPORTANT		
	Segment #12							
P765	Segment #12 Frequency Setpoint	0.0	-500.0	{Hz}	500.0	If $P112 = 1$, negative sign forces reverse direction		
P766	Segment #12 Accel/Decel Time	20.0	0.0	{sec}	3600.0			
РТБТ	Segment #12 Time in current step	0.0 0	0.0 0	{P708} {P708}	6553.5 65535	Scaling/units depend on P708 Skip segment if time = 0		
P768	Segment #12 Digital Output State	0	Value set in P768 Relay (Bit 0) TB14 (Bit 1) I/O option Relay (Bit 2 NOTE: P441 is the F optional Digital I/O n	0 1 2 3 0 1 0 1 0 0 1 1 0 0 1 1 0 0 0 0 0 0 0 0 0 0 0 Relay Output (TB-nodule (ESVZAL0, 0 0 0 0	4 5 6 7 0 1 0 1 0 0 1 1 1 1 1 1 19, 20, 21) of the ESVZAL1). ESVZAL1.	bit = 0: OFF (De-energized) bit = 1: ON (Energized) The corresponding digital output/relay must be set to accept data from the sequencer: P140, P142, P441 = 27		
P769	Segment #12 TB30 Analog Output Value	0.00	0.00	{VDC}	10.00	TB30 configuration parameter must be set to accept this value: $P150 = 10$		
	Segment #13							
סררק	Segment #13 Frequency Setpoint	0.0	-500.0	{Hz}	500.0	If $P112 = 1$, negative sign forces reverse direction		
ו ררק	Segment #13 Accel/Decel Time	20.0	0.0	{sec}	3600.0			
9772	Segment #13 Time in current step	0.0 0	0.0 0	{P708} {P708}	6553.5 65535	Scaling/units depend on P708 Skip segment if time = 0		
PTT3	Segment #13 Digital Output State	0	Value set in P773 Relay (Bit 0) TB14 (Bit 1) I/O option Relay (Bit 2 NOTE: P441 is the F optional Digital I/O n	0 1 2 3 0 1 0 1 0 0 1 1 0 0 1 1 1 0 0 0 0 1 0 0 0 0 0 1 0 0 0 0 0 Relay Output (TB-nodule (ESVZAL0, (TB-nodule (ESVZAL0, 10)	4 5 6 7 0 1 0 1 0 0 1 1 1 1 1 1 19, 20, 21) of the ESVZAL1). ESVZAL1.	bit = 0: OFF (De-energized) bit = 1: ON (Energized) The corresponding digital output/relay must be set to accept data from the sequencer: P140, P142, P441 = 27		
РТТЧ	Segment #13 TB30 Analog Output Value	0.00	0.00	{VDC}	10.00	TB30 configuration parameter must be set to accept this value: $P150 = 10$		
	Segment #14							
РЛЛ5	Segment #14 Frequency Setpoint	0.0	-500.0	{Hz}	500.0	If $P112 = 1$, negative sign forces reverse direction		
РЛЛБ	Segment #14 Accel/Decel Time	20.0	0.0	{sec}	3600.0			
ררר	Segment #14 Time in current step	0.0 0	0.0 0	{P708} {P708}	6553.5 65535	Scaling/units depend on P708 Skip segment if time = 0		
פררק	Segment #14 Digital Output State	0	Value set in P778 Relay (Bit 0) TB14 (Bit 1) I/O option Relay (Bit 2 NOTE: P441 is the F optional Digital I/O n	0 1 2 3 0 1 0 1 0 0 1 1 0 0 1 1 1 0 0 1 1 1 0 0 0 0 0 1 0 0 0 0 0 0 Relay Output (TB-nodule (ESVZALO, 0 0 0 0 0 0	4 5 6 7 0 1 0 1 0 0 1 1 1 1 1 1 19, 20, 21) of the ESVZAL1). ESVZAL1.	bit = 0: OFF (De-energized) bit = 1: ON (Energized) The corresponding digital output/relay must be set to accept data from the sequencer: P140, P142, P441 = 27		
פררק	Segment #14 TB30 Analog Output Value	0.00	0.00	{VDC}	10.00	TB30 configuration parameter must be set to accept this value: $P150 = 10$		

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Code	·	Possible	e Settings			
No.	Name	Default	Selection			IMPORTANT
	Segment #15					
P780	Segment #15 Frequency Setpoint	0.0	-500.0	{Hz}	500.0	If $P112 = 1$, negative sign forces reverse direction
ו פרק	Segment #15 Accel/Decel Time	20.0	0.0	{sec}	3600.0	
P182	Segment #15 Time in current step	0.0 0	0.0 0	{P708} {P708}	6553.5 65535	Scaling/units depend on P708 Skip segment if time = 0
P183	Segment #15 Digital Output State	0	Value set in P783 Relay (Bit 0) TB14 (Bit 1) I/O option Relay (Bit 2 NOTE: P441 is the P optional Digital I/O m	0 1 2 3 0 1 0 1 0 0 1 1 0 0 1 1 1 0 0 1 1 1 0 0 0 0 0 1 0 0 0 0 0 0 Relay Output (TB-nodule (ESVZAL0, (TB-nodule (TB-	4 5 6 7 0 1 0 1 0 0 1 1 1 1 1 1 19, 20, 21) of the ESVZAL1). ESVZAL1.	bit = 0: OFF (De-energized) bit = 1: ON (Energized) The corresponding digital output/relay must be set to accept data from the sequencer: P140, P142, P441 = 27
P784	Segment #15 TB30 Analog Output Value	0.00	0.00	{VDC}	10.00	TB30 configuration parameter must be set to accept this value: $P150 = 10$
	Segment #16					
P785	Segment #16 Frequency Setpoint	0.0	-500.0	{Hz}	500.0	If $P112 = 1$, negative sign forces reverse direction
P786	Segment #16 Accel/Decel Time	20.0	0.0	{sec}	3600.0	
רפרק	Segment #16 Time in current step	0.0 0	0.0 0	{P708} {P708}	6553.5 65535	Scaling/units depend on P708 Skip segment if time = 0
P788	Segment #16 Digital Output State	0	Value set in P788 Relay (Bit 0) TB14 (Bit 1) I/O option Relay (Bit 2 NOTE: P441 is the P optional Digital I/O m	0 1 2 3 0 1 0 1 0 0 1 1 0 0 1 1 1 0 0 0 0 1 0 0 0 0 0 Relay Output (TB-nodule (ESVZAL0, 0) 0) 0)	4 5 6 7 0 1 0 1 0 0 1 1 1 1 1 1 19, 20, 21) of the ESVZAL1). ESVZAL1.	bit = 0: OFF (De-energized) bit = 1: ON (Energized) The corresponding digital output/relay must be set to accept data from the sequencer: P140, P142, P441 = 27
P789	Segment #16 TB30 Analog Output Value	0.00	0.00	{VDC}	10.00	TB30 configuration parameter must be set to accept this value: $P150 = 10$
	End Segment					
P190	End Segment: Frequency Setpoint	0.0	-500.0	{Hz}	500.0	If $P112 = 1$, negative sign forces reverse direction
ו פרק	End Segment: Accel/Decel Time	5.0	0.0	{sec}	3600.0	
9792 2019	End Segment: Delay before P793, 794 & 795 activation		0.0 0	{P708} {P708}	6553.5 65535	Scaling/units depend on P708
P793	End Segment: Digital Output State		Value set in P793 Relay (Bit 0) TB14 (Bit 1) I/O option Relay (Bit 2 NOTE: P441 is the P optional Digital I/O n	0 1 2 3 0 1 0 1 1 0 0 1 1 1 0 0 1 1 1 0 0 0 0 0 8 0 0 0 0 8 0 0 0 0 0 0 0 0 0 8 0 0 0 0	4 5 6 7 0 1 0 1 0 0 1 1 1 1 1 1 19, 20, 21) of the ESVZAL1). ESVZAL1.	bit = 0: OFF (De-energized) bit = 1: ON (Energized) The corresponding digital output/relay must be set to accept data from the sequencer: P140, P142, P441 = 27

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Code		Possible	e Settings			IMPODIANI		
No.	Name	Default	Selection			IMPORTANT		
P794	End Segment: TB30 Analog Output Value	0.00	0.00	{VDC}	10.00	TB30 configuration parameter must be set to accept this value: $P150 = 10$		
P795	End Segment:	0	0 Keep Runi	ning		Recovery: Toggling the START SEQUENCE will		
	Drive Action		1 Stop (base	ed on P111)		start the cycle from 'end segment Stop' or 'end		
	2 Coast to Stop			Segment Do Diake .				
			3 Quick Stop	p (per P127)				
			4 Coast with	n DC Brake				
	5 Ramp with DC Brake			_				
			WARNING! If P795 = 0 th in the interim speed source	nen toggling th where TB13X depending on	e start sequenc is open the drive the drive config	e input will also restart the sequencer cycle but e will ramp to the standard or specified alternate uration.		



WARNING

If the input defined to "Start Sequence" is opened during a sequence, the drive will exit sequencer mode and will run at the specified standard or alternate speed source (dependent on drive configuration).



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ON





WARNING

If the input defined to "Start Sequence" is opened during a sequence, the drive will exit sequencer mode and will run at the specified standard or alternate speed source (dependent on drive configuration).



4.5.9.2 Sequencer Flow Diagram Right





4.5.9.3 Sequencer Status





NOTE

On the "End Segment", the output voltage is not present until after the end segment delay P792 has expired. On the other segments the output voltage is present on entry to the segment. The same is true for the digital outputs.

(1) The drive can only be restarted if the error message has been reset.

Troubleshooting and Diagnostics



5 Troubleshooting and Diagnostics

5.1 Status/Warning Messages

	Status / Warning	Cause	Remedy			
br	DC-injection brake active	DC-injection brake activated • activation of digital input (P121P124 = 18) • automatically (P110 = 2, 46) • automatically (P111 = 1, 3)	Deactivate DC-injection brake deactivate digital input automatically after P175 time has expired			
ЬF	Drive ID warning	The Drive ID (P502) stored on the EPM does not match the drive model.	 Verify motor data (P302P306) and perform Auto Calibration. Set drive mode (P300) to 0 or 1 Reset the drive (P199 to 3 or 4) and reprogram. 			
CAL	Motor Auto-calibration active	Refer to P300, P399	Motor Auto-calibration is being performed			
cE	An EPM that contains valid data from a previous software version has been installed	An attempt was made to change parameter settings	Parameter settings can only be changed after the EPM data is converted to the current version (P199 = 5)			
EL	Current Limit (P171) reached	Motor overload	 Increase P171 Verify drive/motor are proper size for application 			
dEC	Decel Override	The drive has stopped decelerating to avoid tripping into HF fault, due to excessive motor regen (2 sec max).	If drive trips into <i>HF</i> fault: Increase P105, P126 Install Dynamic Braking option 			
Err	Error	Invalid data was entered, or an invalid command was attempted				
FEL	Fast Current Limit	Overload	Verify drive/motor are proper size for application			
FSE	Flying Restart Attempt after Fault	P110 = 5,6				
GE	OEM Settings Operation warning	An attempt was made to change parameter settings while the drive is operating in OEM Settings mode.	In OEM Settings mode (P199 = 1), making changes to parameters is not permitted.			
GF	OEM Defaults data warning	An attempt was made to use (or reset to) the OEM default settings (P199 = 1 or 2) using an EPM without valid OEM data.	Install an EPM containing valid OEM Defaults data			
LC	Fault Lockout	The drive attempted 5 restarts after a fault but all attempts were unsuccessful $(P110 = 36)$	 Drive requires manual reset Check Fault History (P500) and correct fault condition 			
PdEC	PID Deceleration Status	PID setpoint has finished its ramp but the drive is still decelerating to a stop.				
PId	PID Mode Active	Drive has been put into PID Mode.	Refer to P200			
SLP	Sleep Mode is active	Refer to P240P242				
SP	Start Pending	The drive has tripped into a fault and will automatically restart ($P110 = 36$)	To disable Auto-Restart, set P110 = 02			
SPd	PID Mode disabled.	Drive has been taken out of PID Mode. Refer to P200.				
StoP	Output frequency = 0 Hz (outputs U, V, W inhibited)	Stop has been commanded from the keypad, terminal strip, or network	Apply Start command (Start Control source depends on P100)			

(1) The drive can only be restarted if the error message has been reset.

5.2 Drive Configuration Messages

When the Mode button is pressed and held, the drive's display will provide a 4-digit code that indicates how the drive is configured. If the drive is in a Stop state when this is done, the display will also indicate which control source commanded the drive to Stop (the two displays will alternate every second).

Configuration Display							
Format = x.y.zz	x = Control Source:	y = Mode:	zz = Reference:				
	L = Local Keypad E = Terminal Strip r = Remote Keypad n = Network	5 = Speed mode P = PID mode L = Torque mode C = Sequencer mode	$\begin{array}{c} \label{eq:constraints} \end{cases} $				
	Example: L_5_CP = Local Keypad Start control, Speed mode, Keypad speed reference E_P_EU = Terminal Strip Start control, PID mode, 0-10 VDC setpoint reference E_C_I2 = Terminal Strip Start control, Sequencer Operation (Speed mode), Segment #12 n_E_P2 = Network Start control, Vector Torque mode, Preset Torque #2 reference n_5_D3 = Network Start control, Speed mode, Speed reference from Sequencer segment #03						
	Stop Source Display						
Format = x_5EP	L_SEP = Stop command came from Local Keypad L_SEP = Stop command came from Terminal Strip r_SEP = Stop command came from Remote Keypad r_SEP = Stop command came from Network						

5.3 Fault Messages

The messages below show how they will appear on the display when the drive trips. When looking at the Fault History (P500), the F_{-} will not appear in the fault message.

	Fault	Cause	Remedy (1)
F_AF	High Temperature fault	Drive is too hot inside	Reduce drive load Improve cooling
F_AL	Assertion Level fault	 Assertion Level switch is changed during operation P120 is changed during operation P100 or P121P124 are set to a value other than 0 and P120 does not match the Assertion Level Switch. 	 Make sure the Assertion Level switch and P120 are both set for the type of input devices being used, prior to setting P100 or P121P124. Refer to 3.2.3 and P120.
F_bF	Personality fault	Drive Hardware	Cycle Power
F_CF	Control fault	An EPM has been installed that is either blank or corrupted	 Power down and install EPM with valid data Reset the drive back to defaults (P199 = 3, 4)
F_cF	Incompatible EPM fault	An EPM has been installed that contains data from an incompatible parameter version	 If problem persists, contact factory technical support
F_cFt	Forced Translation fault	An EPM from an old drive put in new drive causes drive to trip F_cFT fault.	Press [M] (mode button) twice to reset

Troubleshooting and Diagnostics

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	Fault	Cause	Remedy (1)		
F_dbF	Dynamic Braking fault	Dynamic braking resistors are overheating	 Increase active decel time (P105, P126, P127). Check mains voltage and P107 		
F_EF	External fault	 P121P124 = 21 and that digital input has been opened. P121P124 = 22 and that digital input has been closed. 	Correct the external fault condition Make sure digital input is set properly for NC or NO circuit		
F_F I	EPM fault	EPM missing or defective	Power down and replace EPM		
F_F2 F_F 12	Internal faults		Contact factory technical support		
F_Fnr	Control Configuration Fault	The drive is setup for REMOTE KEYPAD control (P100=2 or 5) but is not setup to communicate with a remote keypad	Set P400 = 1, or P600 = 1		
		The drive is setup for NETWORK ONLY control (P100=3) but is not setup for network communications	Set P400 or P600 to a valid network communications protocol selection		
F_FoL	TB25 (4-20 mA signal) Threshold fault	4-20 mA signal (at TB-25) drops below the value set in P164.	Check signal/signal wireRefer to parameters P163 and P164.		
F_GF	OEM Defaults data fault	Drive is powered up with P199 =1 and OEM settings in the EPM are not valid.	Install an EPM containing valid OEM Defaults data or change P199 to 0.		
F_HF	High DC Bus Voltage fault	Mains voltage is too high	Check mains voltage and P107		
		Decel time is too short, or too much regen from motor	Increase active decel time (P105, P126, P127) or install Dynamic Braking option		
F_ IL	Digital Input Configuration fault (P121	More than one digital input set for the same function	Each setting can only be used once (except settings 0 and 3)		
	P124)	Only one digital input configured for MOP function (Up, Down)	One input must be set to MOP Up, another must be set to MOP Down		
		PID mode is entered with setpoint reference and feedback source set to the same analog signal	Change PID setpoint reference (P121P124) or feedback source (P201).		
		One of the digital inputs (P121P124) is set to 10 and another is set to 1114.			
		One of the digital inputs (P121P124) is set to 11 or 12 and another is set to 13 or 14.	Reconfigure digital inputs		
		PID enabled in Vector Torque mode (P200 = 1 or 2 and P300 = 5)	PID cannot be used in Vector Torque mode		
F_JF	Remote keypad fault	Remote keypad disconnected	Check remote keypad connections		
F_LF	Low DC Bus Voltage fault	Mains voltage too low	Check mains voltage		
F_n ld	No Motor ID fault	An attempt was made to start the drive in Vector or Enhanced V/Hz mode prior to performing the Motor Auto-calibration	Refer to parameters P300P399 for Drive Mode setup and calibration.		
F_nEF	Module communication fault	Communication failure between drive and Network Module.	Check module connections		
F_nF I F_nF9	Network Faults	Refer to the module documentation. for Causes and Remedies.			



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	Fault	Cause	Remedy ⁽¹⁾		
F_OF	Output fault:	Output short circuit	Check motor/motor cable		
	Transistor fault	Acceleration time too short	Increase P104, P125		
		Severe motor overload, due to: Mechanical problem Drive/motor too small for application	 Check machine / system Verify drive/motor are proper size for application 		
		Boost values too high	Decrease P168, P169		
Exce the r		Excessive capacitive charging current of the motor cable	Use shorter motor cables with lower charging current Use low capacitance motor cables Install reactor between motor and drive.		
		Failed output transistor	Contact factory technical support		
F_OF I	Output fault: Ground fault	Grounded motor phase	Check motor and motor cable		
		Excessive capacitive charging current of the motor cable	Use shorter motor cables with lower charging current		
F_PF	Motor Overload fault	Excessive motor load for too long	 Verify proper setting of P108 Verify drive and motor are proper size for application 		
F_rF	Flying Restart fault	Controller was unable to synchronize with the motor during restart attempt; (P110 = 5 or 6)	Check motor / load		
F_SF	Single-Phase fault	A mains phase has been lost	Check mains voltage		
F_UF	Start fault	Start command was present when power was applied (P110 = 0 or 2).	 Must wait at least 2 seconds after power-up to apply Start command Consider alternate starting method (P110). 		
F_FAU	TB5 (0-10V signal) Threshold fault	0-10V signal (at TB5) drops below the value set in P158.	Check signal/signal wireRefer to parameters P157 and P158		

(1) The drive can only be restarted if the error message has been reset.

Appendix A

A.1 Permissable Cable Lengths

The table herein lists the permissable cable lengths for use with an SMV inverter with an internal EMC filter.

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NOTE

This table is intended as a reference guideline only; application results may vary. The values in this table are based on testing with commonly available low-capacitance shielded cable and commonly available AC induction motors. Testing is conducted at worst case speeds and loads.

Maximum Permissible Cable Lengths (Meters) for SMV Model with Internal EMC Filters									
Mains	Model	4 kHz Carrier (P166 = 0)		6 kHz Carrier (P166 = 1)		8 kHz Carrier (P166 = 2)		10 kHz Carrier (P166 = 3)	
		Class A	Class B	Class A	Class B	Class A	Class B	Class A	Class B
	ESV251dd2SFd	38	12	35	10	33	5	30	N/A
8	ESV371dd2SFd	38	12	35	10	33	5	30	N/A
PE)	ESV751dd2SFd	38	12	35	10	33	5	30	N/A
0 V, 1 (2/1	ESV112dd2SFd	38	12	35	10	33	5	30	N/A
54	ESV152dd2SFd	38	12	35	10	33	5	30	N/A
	ESV222dd2SFd	38	12	35	10	33	5	30	N/A
	ESV371dd4TFd	30	4	25	2	20	N/A	10	N/A
	ESV751dd4TFd	30	4	25	2	20	N/A	10	N/A
e	ESV112004TF0	30	4	25	2	20	N/A	10	N/A
-phas	ESV152dd4TFd	30	4	25	2	20	N/A	10	N/A
0 V,3 3/PE)	ESV222dd4TFd	30	4	25	2	20	N/A	10	N/A
)0/48	ESV302dd4TFd	30	4	25	2	20	N/A	10	N/A
4	ESV402004TF0	54	5	48	3	42	2	N/A	N/A
	ESV552dd4TFd	54	5	48	3	42	2	N/A	N/A
	ESV752dd4TFd	54	5	48	3	42	2	N/A	N/A

NOTE: The "dd" and "d" symbols are place holders in the Model part number that contain different information depending on the specific configuration of the model. Refer to the SMV Type Number Designation table in section 2.2 for more information.