

Series 22H Line Regenerative Vector Drive

**10 thru 50 Hp
10 thru 50 Hp**

**230 VAC
460 VAC**

**3 Phase - 50/60 Hz
3 Phase - 50/60 Hz**



Applications: Variable torque, constant torque or constant horsepower applications. New installations, replacements and original equipment manufacturers. (OEM).

Features: NEMA 1 enclosure as standard. Output frequency 0-500Hz with peak overload capability of 170-200%. Automatic tuning to motor and full rated torque down to zero speed. Digital speed or torque control. Built in two and three input PID process control loop.

Design Specifications

- Process follower
±5VDC 0-5 VDC,
±10VDC, 0-10 VDC ,
4-20mA, digital via keypad
or optional RS232/485
- Linear or S-curve deceleration
- Controlled reversing
- 15 preset speeds
- 2 assignable analog outputs
- 2 assignable logic outputs
- 2 assignable relay outputs
- 2 assignable analog inputs
- Motor shaft orient to marker

Operator Keypad

- Forward/Reverse command
- Motor RUN and JOG
- Local/Remote key
- Stop command
- 32 character display
- Remote mount to 100 feet (60m)
from control
- NEMA 4X enclosure when
mounted on panel

Environmental and Operating Conditions

- Input voltage
Three phase 200-240 VAC ±10%
Three phase 378-480 VAC ±10%
- Input frequency
50 or 60Hz ±5%
- Service factor - 1.0
- Duty - continuous
- Humidity - 90% max RH non-condensing
- Altitude - 3300 feet (1000m)
max without derate

Protective Features

- Adjustable current limit
- Isolated control circuitry
- Digital display for fault conditions
- Selectable automatic restart at
momentary power loss
- DC bus charge indicator
- Cause of last 31 trips retained
in memory

Output Ratings	Overload Capacity	150% for 60 seconds, 170-200% for 3 seconds for constant torque 115% for 60 seconds for variable torque
	Frequency	0-500 Hz
	Voltage	0-Maximum input voltage (RMS)
Input Ratings	Frequency	50 or 60 Hz ±5%
	Voltage	180 - 264 VAC; 340 - 528 VAC
	Phase	Three phase
	Impedance	3.0% minimum required
Control Spec	Control Method	Microprocessor controlled PWM output
	PWM Frequency	Adjustable 1-5kHz STD, 1-16 kHz quiet
	Speed Setting	±5 VDC, 0-5 VDC ±10 VDC, 0-10 VDC, 4-20 mA; digital via keypad, RS232/485
	Accel/Decel	0-3600 sec
	Motor Matching	Automatic tuning to motor with manual override
Motor Feedback	Feedback Type	Incremental encoder coupled to motor shaft
	Pulses/Rev	60-15,000 selectable, 1024 standard
	Voltage Output	2 channel in quadrature, 5 VDC, differential
	Marker Pulse	Required for position orientation
	Power Input	5 VDC, 300 mA maximum
	Max. Frequency	1 MHz
	Positioning	Optional buffered encoder pulse train output for position loop controller
Protective Functions	Vector Trip	Missing control power, over current, over voltage, under voltage, motor over speed Over temperature (motor or control), output shorted or grounded, motor overload
	External Output	LED indicator for trip conditions, 4 assignable logic outputs, 2 assignable analog outputs 0-5 VDC
	Short Circuit	Phase to phase, phase to ground
LCD Display	Running	Output frequency, motor RPM; output current, voltage (selectable)
	Setting	Parameter values for setup and review
	Trip	Separate message for each trip, last 31 trips retained in memory
Ambient Conditions	Temperature	-10 to +40°C for UL listing
	Cooling	Forced air included when required

OPTIONS: See pages 104-105 for optional Expansion Boards including RS-232, RS-485.

Series 22H Line Regenerative Vector Drive Output Ratings

Catalog Number	Size	Heavy Duty			Normal Duty			List Price	Mult. Sym.
		Hp	Continuous	Peak	Hp	Continuous	Peak		
230 Volts - Three Phase									
ZD22H210-EL	C+	10	28	56	10	28	32	10,019	E1
ZD22H215-EL	C+	15	42	72	15	42	48	11,133	E1
ZD22H220-EL	C+	20	55	110	20	55	62	13,034	E1
ZD22H225-EL	C+	25	68	116	25	68	78	15,226	E1
ZD22H230-EL	D+	30	80	136	30	80	92	16,557	E1
ZD22H240-EL	D+	40	105	200	40	105	120	20,617	E1
ZD22H250-EL	D+	50	130	225	50	130	150	25,308	E1
460 Volts - Three Phase									
ZD22H410-EL	C+	10	15	30	10	15	17	10,431	E1
ZD22H415-EL	C+	15	21	36	15	21	24	11,345	E1
ZD22H420-EL	C+	20	27	50	20	27	31	13,212	E1
ZD22H425-EL	C+	25	34	58	25	34	39	14,888	E1
ZD22H430-EL	D+	30	40	70	30	40	46	16,806	E1
ZD22H440-EL	D+	40	55	100	40	55	63	20,730	E1
ZD22H450-EL	D+	50	65	115	50	65	75	25,015	E1

Dimensions in/(mm)

Size	Outside			Mounting		Approx. Shpg. Wgt.
	Height	Width	Depth	Height	Width	
C+	30 (762)	11.5 (292)	12.2 (310)	29.25 (743)	10.5 (267)	160
D+	36 (914)	14.5 (368)	12.2 (310)	35.25 (895)	13.50 (343)	280

Series 15H, 18H, and 22H Keypad Extension Cable

For the convenience of our customers, we offer a connector plug/cable assembly. This assembly provides the connectors from the keypad to the control for remote keypad operation.

Catalog Number	Cable Extension Length	List Price	Mult. Sym.	Approx. Shpg. Wgt.
CBLH015KP	5 feet (1.5 meter)	73	E8	1
CBLH030KP	10 feet (3.0 meter)	104	E8	1
CBLH046KP	15 feet (4.6 meter)	133	E8	1
CBLH061KP	20 feet (6.1 meter)	223	E8	2
CBLH091KP	30 feet (9.1 meter)	341	E8	3
CBLH152KP	50 feet (15.2 meter)	447	E8	3
CBLH229KP	75 feet (22.9 meter)	492	E8	4
CBLH305KP	100 feet (30.5 meter)	610	E8	5

VS1PFB Bypass Panels

Integrated Bypass Module

Operator Station:

- Speed – Speed pot for operating in Hand mode
- Hand – Speed is controlled by speed pot
- Off – Motor is off
- Auto – Accepts signal from process
- ASD – Drive is on and operational
- Bypass – Motor is operated "across the line." Drive is off
- Test mode allows the control to be programmed while in Bypass mode.



Indicating lights:

- Amber Power Light
- ASD – On when ASD is controlling motor
- Bypass – On when in normal bypass, Slow blinking when commanded from Remote source or from drive
- Fault – On when ASD is faulted, Slow blinking where critical fault occurs



Hp	Packaged Drive Catalog Number	Output Amps	Frame
230V Controls			
7.5	VS1PFB27-1	24	B2
10	VS1PFB210-1	32	B2
15	VS1PFB215-1	46	B2
20	VS1PFB220-1	60	C2
25	VS1PFB225-1	74	C2
30	VS1PFB230-1	88	E2
40	VS1PFB240-1	115	E2
460V Controls			
7.5	VS1PFB47-1	12	B4
10	VS1PFB410-1	18	B4
15	VS1PFB415-1	24	B4
20	VS1PFB420-1	30	C4
25	VS1PFB425-1	39	C4
30	VS1PFB430-1	45	E4
40	VS1PFB440-1	61	E4
50	VS1PFB450-1	75	G4
60	VS1PFB460-1	91	G4
75	VS1PFB475-1	110	H4
100	VS1PFB4100-1	152	L4
125	VS1PFB125-1	183	L4

Frame	Dimensions in (mm)			Approx. Weight Lbs
	Height in (mm)	Width in (mm)	Depth in (mm)	
B2	52(1319)	8.6(218)	10.3 (261)	35
C2	60(1522)	10.5(266)	10.7 (271)	65
E2	62(1573)	12.6(320)	11.9 (302)	85
B4	42(1066)	8.6(218)	10.3 (261)	35
C4	48(1218)	10.5(266)	10.7 (271)	65
E4	54(1370)	12.6(320)	11.9 (302)	85
G4	57(1446)	12.3(312)	13.8 (350)	100
H4	65(1649)	12.3(312)	14.8 (375)	125
L4	62(1573)	36(913)	18.2 (462)	150

Contact your local District Office for Larger HP versions up to 700 Hp

Optional Communications Expansion Boards

Type	Catalog Number
DeviceNet	VS1PF-DNET
ModBus-RTU	VS1PF-MBUS
Profibus	VS1PF-PBUS
MetasysN2	VS1PF-MET V2
Modbus TCP/IP	VS1PF-MBTCP
LonWorks	VS1PF-LON
BacNet	VS1PF-BAC

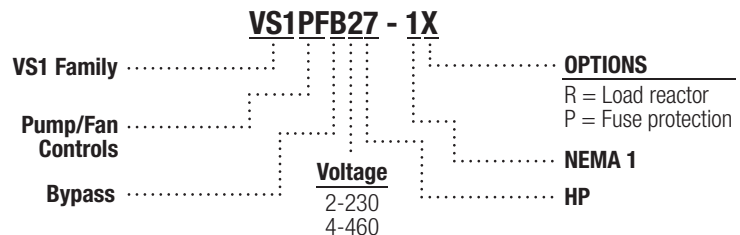
Supporting Literature

VS1PF Manual: MN763 VS1PFB Manual: MN763BP
 VS1PF Data Sheet: FL763 VS1PFB Brochure: FL768



Service Conditions

- Altitude:** 1,000 m (3,300 ft) Maximum
Ambient Temperature: -10°C (14°F) to 40°C (104°F)
Storage Temperature: -20°C (-2°F) to 65°C (149°F)
Relative Humidity: 0% to 95%, non-condensing
Intermittent Overload: 110% overload capacity for up to 1 minute



VS1PFB Bypass Panels

HVAC

	Packaged Drive	List Price	With Drive Fuses	List Price	With Load Reactor	List Price	Mult. Sym.
◇	VS1PFB27-1	3,899	VS1PFB27-1P	4,099	VS1PFB27-1R	4,397	E1
◇	VS1PFB210-1	4,086	VS1PFB210-1P	4,336	VS1PFB210-1R	4,614	E1
◇	VS1PFB215-1	5,207	VS1PFB215-1P	5,507	VS1PFB215-1R	5,764	E1
◇	VS1PFB220-1	5,933	VS1PFB220-1P	6,258	VS1PFB220-1R	6,524	E1
◇	VS1PFB225-1	6,928	VS1PFB225-1P	7,428	VS1PFB225-1R	7,618	E1
◇	VS1PFB230-1	8,008	VS1PFB230-1P	8,558	VS1PFB230-1R	8,903	E1
◇	VS1PFB240-1	10,259	VS1PFB240-1P	10,859	VS1PFB240-1R	11,460	E1
◇	VS1PFB47-1	3,928	VS1PFB47-1P	4,128	VS1PFB47-1R	4,346	E1
◇	VS1PFB410-1	3,975	VS1PFB410-1P	4,225	VS1PFB410-1R	4,412	E1
◇	VS1PFB415-1	4,753	VS1PFB415-1P	5,053	VS1PFB415-1R	5,277	E1
◇	VS1PFB420-1	5,709	VS1PFB420-1P	6,034	VS1PFB420-1R	6,265	E1
◇	VS1PFB425-1	6,522	VS1PFB425-1P	6,872	VS1PFB425-1R	7,078	E1
◇	VS1PFB430-1	7,529	VS1PFB430-1P	7,904	VS1PFB430-1R	8,118	E1
◇	VS1PFB440-1	9,542	VS1PFB440-1P	9,942	VS1PFB440-1R	10,163	E1
◇	VS1PFB450-1	11,024	VS1PFB450-1P	11,434	VS1PFB450-1R	11,752	E1
◇	VS1PFB460-1	12,060	VS1PFB460-1P	12,485	VS1PFB460-1R	13,006	E1
◇	VS1PFB475-1	14,613	VS1PFB475-1P	15,163	VS1PFB475-1R	15,878	E1
◇	VS1PFB4100-1	19,212	VS1PFB4100-1P	19,797	VS1PFB4100-1R	20,477	E1
◇	VS1PFB4125-1	20,417	VS1PFB4125-1P	21,027	VS1PFB4125-1R	21,890	E1

Notes: Larger sizes up to 700 Hp available. Contact Baldor.

VS1SP and VS1GV controls may be substituted in standard Hoffman style enclosure. See the following Packaged Drives pages.

◇ Stock Model Numbers

VS1PF Packaged Drives



Packaged Baldor V*S Drives provide custom solutions for customer applications. Packaged Baldor V*S Drives are available for VS1PF drives from 7.5 to 700HP. Standard packaged options are shown in this catalog including NEMA 1, 12, 4, 4X & 3R enclosures, Input fusing & circuit breakers, door mounted operators, input/output contactors, bypass, line/load reactors, control transformers, dynamic braking as well as many other peripheral equipment options. If you don't see the option you need, please contact the factory via your Local Baldor District Sales Office, and we will custom engineer it for you.



Baldor Drives Center Test Capabilities

Large HP Capability

Test facilities utilize Baldor regenerative control technology on dynamometers for maximum performance and energy efficiency. Capabilities exist for continuous loading from fractional to 800 Hp with the largest dyno being capable of intermittent loading over 1000 Hp. The dynamometers found throughout the test facilities are fully instrumented with equipment to read temperature, speed, torque and power (volts, amps, watts, PF, Hz, VA, VAR, harmonics, etc.) and are fully automated. Hipotronics variable AC sources are used in conjunction with our largest dynamometers to enable testing at high, low and nominal line voltages and all points in between. The Hipotronics units are capable of up to 2000 amps, 0-4160 volts and are equipped with Yokogawa Power Analyzers for power measurements. Independent control of each phase voltage allows for the introduction of a degree of phase imbalance to test "real world" conditions. The system's PC monitors the Hipotronics settings and test conditions and logs test data.



AST-35 HALT/HASS Chamber

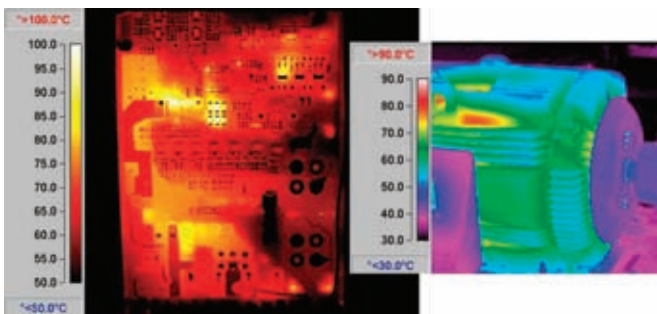


The AST-35 chamber is designed specifically for very aggressive temperature change rates and high levels of multi-axis repetitive shock vibration. It can be used for a variety of testing such as HALT, HASS, Step Stress, etc. It is Liquid Nitrogen (LN2) cooled with a temperature range of -100°C to +200°C (-148°F to 392°F). It can provide up to 50grms of random vibration (2 Hz to 5 kHz). The vibration table can support a payload of 200 pounds. It has a 42"X42"X40" work area and product temperature change rates greater than 70°C per minute can be achieved. No matter what method of testing is chosen, the AST system provides extreme stresses to help quickly identify potential product weaknesses that in turn help produce a more reliable product.

Thermal Testing and Analysis

Several thermal/environmental chambers have testing capabilities from -100° to +200°C and humidity capabilities from 10% to 95% RH. The chambers can be programmed to cycle between multiple set points for varying times.

A Fluke Infrared Camera is used for thermal imaging. Infrared technology is utilized to analyze components such as IC chips and PCB's, heat sink thermal resistance, fan cooling effects, thermal dissipation characteristics of motors, bearing and brush temperatures and many other applications.



Baldor Drives Center

Test Capabilities

Commitment to Safety

Baldor is committed to accident and injury prevention! All test facility personnel are trained and certified in Basic First Aid and CPR. In addition, the lab and production areas have nationally certified First Responders with Pre Hospital Trauma Life Support (PHTLS) training.

Calibration

A Fluke 5520A calibrator along with other NIST traceable standards is used to calibrate the majority of the electronic instruments within Baldor's test facilities. In house calibration services are also performed on final test panels and electronic instrumentation for other Baldor plants and facilities.

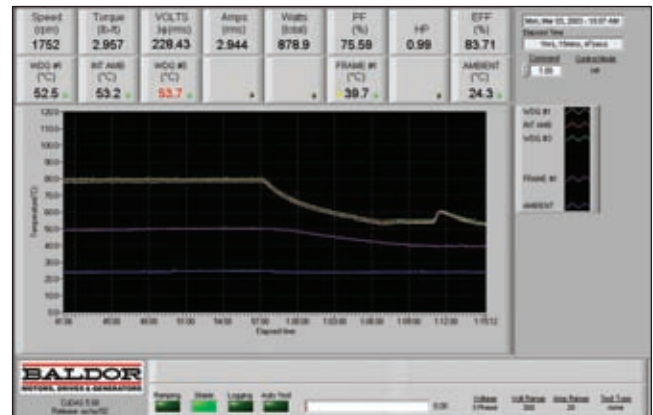


Surface Mount Technology

Surface Mount (SMT) soldering and inspection equipment is used during prototyping of new designs and upgrades. PCB layout, design, evaluation and testing are also performed.

Every control is powered up and load tested before it leaves the plant using an automated system. This system first verifies that each control is programmed correctly using an interface between the test system and BUS. Next, using the VS1 USB interface and standard firmware, the control is commanded to spin a motor. Output speed is verified using external current transducers and the motor is loaded to 150% of rated current. The control cycles between 150% of rated

current and 50% rated current for 2 minutes. Reversal tests are then run to test the braking transistor and resistor functionality. Finally the drive is power cycled, factory defaults are set, and any custom parameters are programmed into the drive. The results of the test, including the serial numbers of the boards in the control are saved in a database. A shipping label is printed and the control is boxed up ready for shipment. Each control takes about 10 minutes to test and up to 5 controls of varying voltages and sizes can be tested at the same time.



Dyno Technology

A Labview application developed by Baldor lab technicians control the dynes and monitors all test conditions. Each dyno utilizes Baldor regenerative drive technology for optimum performance and efficiency. Each is equipped with variable voltage sources and 50/60Hz power. Full instrumentation provides monitoring of temperature, speed, torque, and power (volts, amps, watts, PF, Hz, VA, VAR, harmonics, etc.). The data is transferred directly to computers that control and monitor the entire operation. The system completely automates standard test sequences such as brake tests, heat runs and speed versus torque curve tests. It also provides for custom load profiles such as inertia, pump jack and fan and pump load simulations. Each test station is networked for direct test data storage to the lab servers as well as allowing tests to be monitored remotely.

Porto-Sag PS200

The Porto-Sag PS200 is used to inject voltage sags of controlled magnitude and duration while monitoring the response of the process.

Voltage: 100-277VAC

Current: 200A, 700 A peak for ½ cycle

Sag/Swell duration: ¼ cycle to 10 seconds

Magnitude: 125% to 0% in 5% steps.

360° point on wave control in 1° increments

NSG 2050 Surge Mainframe

The NSG 2050 is a surge generator with pulse amplitudes up to 6.6kV single or 3-phase coupling network. It covers all the widely used burst test specs of IEC, EN, ANSI-IEEE as well as extended manufacturer's requirements.

Baldor Drives Center Test Capabilities

UL, CSA, EMI and Immunity Testing

The test facilities perform required testing for UL approval of Baldor motor and control products and is a participant in the UL Client Test Data Program (CTDP) for UL 508C, UL 2111, UL 1995. Additionally, certifications are held for motor efficiency testing under both CSA and NVLAP. UL short circuit testing for drives products is performed in a specifically designed room. This short circuit room is designed to provide a minimum of 50,000 amps of short circuit current. Electrostatic Discharge (ESD), Electronic Fast Transient (EFT) and burst equipment is used to test EMI and immunity levels of drive products in accordance with CE standards.

Customer Application Testing

The lab routinely tests Baldor products on customer units in the lab.

Hardware/Software Test Systems Design

Lab technicians participate in hardware and software design of lab test equipment, production test equipment and trade show demo units.

Labview applications developed by lab technicians are used throughout the lab and in many locations throughout Baldor. One example is the automation of our dynamometers as described above. Another example is the system used to automate the verification process of new software releases for Baldor drive products. The Labview application interfaces with the control just as a customer would and exercises and monitors all input and output signals of the drive for proper operation and compliance to specified limits. In addition, the system simulates operator keystrokes to the control and monitors motor performance to verify proper operation of the drive under test. Test conditions and results are collected by a PC and stored directly to the lab's network server. This testing runs 24 hours a day, seven days a week for several weeks at a time in order to verify new software versions prior to release. Other applications developed within the lab simulate inertia, fan and pump and pump jack loads, monitor and control long term life testing, speed versus torque curve collection and tensile testing.

Every control is powered up and load tested before it leaves the plant using an automated system. This system first verifies that each control is programmed correctly using an interface between the test system and BUS. Next, using the VS1 USB interface and standard firmware, the control is commanded to spin a motor. Output speed is verified using external current transducers and the motor is loaded to 150% of rated current. The control cycles between 150% of rated current and 50% rated current for two minutes. Reversal tests are then run to test the braking transistor and resistor functionality. Finally the drive is power cycled, factory defaults are set, and any custom parameters are programmed into the drive. The results of the test, including the serial numbers of the boards in the control are saved in a database. A shipping label is printed and the control is boxed up ready for shipment. Each control takes about ten minutes to test and up to five controls of varying voltages and sizes can be tested at the same time.

Alternator Testing

Alternator testing is performed utilizing a 175KVA test bed. The 175KVA test bed is used in developing new alternator concepts and designs. The alternators are driven by a Baldor vector motor and vector control. This technology allows for accurate speed regulation, which in turn provides a constant output frequency from the alternator under its entire load range. The alternators are loaded using two Avtron load banks. One load bank is a 480V, 500KW resistive load bank and the other is a 480V, 375kVA reactive load bank. A single test panel controls both load banks and monitors load and all other conditions during testing.



Lubricating Greases Testing

Two test fixtures are used to determine the performance of lubricating greases in ball bearings under loads at high speed and elevated temperatures. The fixtures are capable of speeds up to 10,000 RPM with 50 pounds of radial loading. Both fixtures have a temperature range from 90°F to 500°F and the failure modes are monitored.

Sound and Vibration

Sound testing is done in a semi-anechoic sound room. An HP 3569A Acoustic Intensity Analyzer and a precision sound level meter are used in accordance with IEEE Standard 85 to run the sound tests. The isolated seismic pad located in the sound room is used in with a SPS390 and OROS OR36 Dynamic Signal Analyzers for no load vibration testing in accordance with NEMA standards.

