Gardner Denver

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VS-PILOT CONTROLLER OPERATING MANUAL

List of contents

General Description

The Gardner Denver rotary screw compressor package is pre–wired with all controls, motor, and frequency converter for 380...500 volts at the time of ordering. External transformers are used for other voltages. It is necessary only to connect the compressor unit to the correct power supply and to the shop air line (and to the appropriate water supply if water cooled). A standard compressor unit consists of the compressor, oil reservoir, oil cooling system and filter, motor type as specified, NEMA 12 starter / control box, and control components as described in the package instruction manual.

This compressor unit features the VS–Pilot controller, which integrates all the control functions under microprocessor control. Its functions include safety and shutdown, compressor regulation, operator control, and advisory / maintenance indicators. The keypad and display provide the operator with a logical control of the compressor and indication of its condition.

Electrical Wiring

The compressor package is factory wired for internal motors and controls. Connections from the electrical supply are made to the three phase terminals and one ground terminal located inside the main controls enclosure. Wiring must be performed only by qualified electricians.

Perform all wiring in accordance with the National Electrical Code (NFPA–70) and any applicable local electrical codes. Note that section 430–2 applies to this package; refer to the frequency converter nameplate for the model, rated voltage, and rated current. To minimize effects of harmonic currents, do not connect to the same feeder as sensitive equipment.

Operation

Refer to Figure 1, page 2. To start compressor operation, press the green start button on the control keypad. To stop operation, press the red stop button on the control keypad. The display indicates the plant pressure, compressor discharge temperature, and a text description of the current operating state.

WARNING

Automatic restarting or electrical shock can cause injury or death. Open and lock main disconnect and any other circuits before servicing unit.

Operation may also be controlled by remote controls. If this is done, the compressor must be activated first from the green start button. Refer to ”Connection to External Controls”, page 17, for more details.

The emergency stop pushbutton is located in the center of the control panel. This should be used for emergency purposes only –– use the keypad stop button for normal controlled stopping.

When you start controller operation, it automatically will operate the compressor unit in the most efficient manner for the demand of the air system. It will start and load the compressor near the programmed target pressure setting. The compressor speed will be constantly adjusted to deliver the same air flow that the plant is demanding, and to maintain pressure near the programmed target pressure. If demand becomes very light, the compressor will run at its minimum speed. If the pressure rises to the stop pressure (7 PSI over target pressure), the compressor will completely stop and relieve all internal pressures.When demand is later resumed, the controller will start and operate the compressor automatically to serve the demand (VS 100).

If the pressure rises to the stop pressure (7 PSI over target pressure), the compressor starts to run unloaded or, depending on the need for compressed air, stops after decelerating and remains in standby mode. If the need for compressed air increases and the pressure drops back to the preset limit, the compressor moves immediately to output mode or restarts automatically (VS 170/240).

VS–Pilot Controller Display

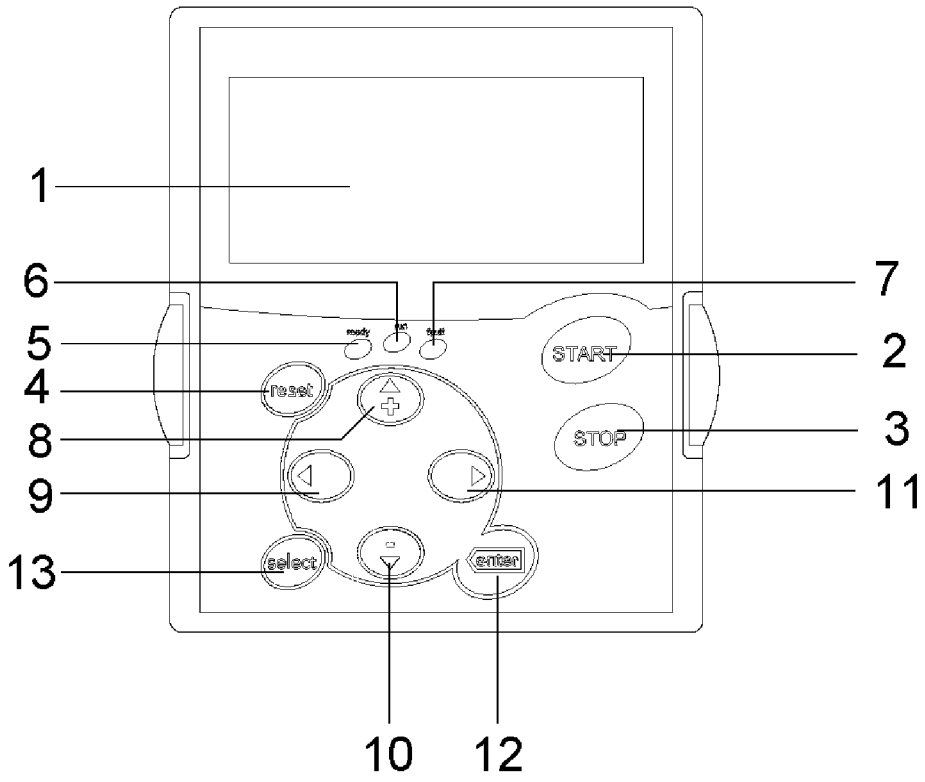


Figure 1 VS–Pilot Compressor Control Panel

Ref. No.	Name of Part
1.	Display
2.	Start
3.	Stop
4.	Reset (resets active faults, returns pressure reading display)
5.	Ready indicator (goes on when power is switched on)
6.	Run indicator (goes on when the unit starts, flashes when STOP has been depressed but the unit has not yet stopped)
7.	Fault indicator (goes on when the operating conditions are not safe or stable and the compressor has stopped)
8.	Scrolls up menus, editing
9.	Enters previous menu, moves cursor left (in Parameter Menu), closes editing (depress 2–3 seconds, returns to main menu)
10.	Scrolls down menus, editing
11.	Enters next menu, moves cursor right (in Parameter Menu), opens editing
12.	Confirms selection, resets fault history
13.	Shows the last two displays alternately

Using the Control Panel

The information on the control panel is arranged in menus and submenus.

The first menu level consists of the main menus M2, M3, M4, M5, M6, and M9.

Example

M2 – location
Monitoring – description of menu contents
V1 V19 – submenu identifiers and numbers

The user can move between the menus using the scrolling keys (⊕,⊖). When an arrow ( ) is shown at the lower right corner of the display, submenus are available. You can enter the next menu level by pressing the right menu key (▷).

Detailed descriptions of the menus are given later in this manual.

When the compressor is started, STATUS is displayed for 30 seconds. Then the display goes over to show the pressure reading. The pressure reading always returns to the display when the compressor controller is not touched for 30 seconds:

V 1.2.
Pressure
BAR

Main Menus

M1 Monitor values V1 V19	Menu shown when Metric units are selected.
M2 **Monitor values** **V1 V19**	Menu shown when Anglo–American units are selected.
M3 **Operate settings** **P1 P4**	
M4 **Service settings** **P1 P11**	
M5 **Active faults** **F0**	
M6 **Fault history** **H1 H30**	
M7 Machine settings G1 G4	Hidden menu, requires password. (M3, P 3.3)
M8 Parameters G1 G11	Hidden menu, requires password (M3, P 3.4)
M9 **System Menu** **S1 S9**	

When power is switched on the compressor display shows the pressure reading (V 2.2.) and the Ready indicator goes on. When the START key is depressed the menu (V 2.1.) presenting the compressor status is displayed. When the compressor starts, the display starts showing the pressure reading after 30 seconds, and the RUN indicator goes on.
You can enter the Monitoring menu by pressing the left menu key (▷).

The scrolling keys (▲,▼) enable you to move between the main menus. Use the right menu key (▷) to enter the submenus.

M2 Monitor values

Code	Function	Unit	Notes
V 1.1.	Status		When the compressor is not running the display shows STOP. When the START key has been depressed, the display shows READY, RUN, REMOTE READY (remote control), OFF LOAD or LIMITER ON (Cf.p.18 Limiting Function).
V 1.2.	Pressure	PSI	Shows delivery pressure of compressor
P 1.3.	Target pressure	PSI	Minimum setting is 43.5 psi and maximum is compressor's maximum pressure.
V 1.4.	Compressor Temp	F	Display shows compressor delivery temperature
V 1.5.	Capacity	%	Display shows capacity relative to maximum capacity
V 1.6.	Running hours	h	Shows compressor's operating hours, resets to zero after 30 000 hours.
V 1.7.	RunHourFactor	time	Shows how many times the hour meter has been reset.
V 1.8.	Oil Change Time	h	Shows the time remaining in the service interval counter
V 1.9.	Oil FilterChange	h	Shows the time remaining in the service interval counter
V 1.10.	Air FilterChange	h	Shows the time remaining in the service interval counter
V 1.11.	OilSepChanTime	h	Shows the time remaining in the service interval counter
V 1.12.	MotorServTime	h	Shows the time remaining in the service interval counter.
V 1.13.	Output Frequency	Hz	Motor frequency
V 1.14.	Motor Speed	rpm	Motor speed
V 1.15.	Motor Current	A	Note! Motor current is different from compressor supply current
V 1.16.	Motor Voltage	V	
V 1.17.	DC–link Voltage	V	Voltage of DC circuit
V 1.18.	Heat Sink Temp	C	Shows temperature of frequency converter heat sink.
V 1.19.	Software Version		

P 2.3. Setting Target Pressure

The compressor's target pressure can be set as follows:
Move to Target Pressure (P 2.3.) in the menu and press the ▷ key. The pressure display starts flashing. You can now use the ▲ and ▼ keys to change the value. Press the Enter key to accept the setting.

M3 Operate Settings

Code	Function	Notes
P 3.1.	Auto Start	Default setting is OFF. The setting ON enables automatic start after a power failure. The compressor will start after a power failure if it has been in READY or RUN state before the failure. Starting delay is 12 seconds.
P 3.2.	Unit Measure	With Metric setting the values are shown in SI units (BAR and C), and the Monitoring menu M1 will be active. With English setting the values are shown in Anglo–American units (PSI and F), and the Monitoring menu M2 will be active.
P 3.3.	Compressor Model	Compressor model selection. The setting is locked with the Machine Password.
P 3.4.	Machine Password	The password will allow you to Machine Settings–menu, service personnel authorized by Gardner Denver have the password.

M4 Service Settings

Code	Function	Min	Max	Unit	Notes
P 4.1.	OilChangInterval	100	9000	h	Default 6000 h.
P 4.2.	Set OilChangTime				Set interval for oil change in service interval counter.
P 4.3.	OilFiltChanInter	100	8000	h	Default 1000 h.
P 4.4.	SetOilFilterTime				Set interval for oil filter change in service interval counter.
P 4.5.	AirFiltChanInter	100	8000	h	Default 1500 h.
P 4.6.	SetAirFiltTime				Set interval for air filter change in service interval counter.
P 4.7.	OilSepChanInter	100	9000	h	Default 4000 h.
P 4.8.	SetOilSepTime				Set interval for oil separator element change in service interval counter.
P 4.9.	MotorServicInter	1000	32000	h	Motor–specific service interval.
P 4.10.	MotorServiceSet				Set interval for motor service in service interval counter
P 4.11.	Service Password				Password gives access to change service interval settings.

When the service interval counter resets to zero and the controller gives a service alarm, carry out the required service procedure. Then reset the service interval counter as follows:
Go to the relevant point in the menu (P 4.2. for oil change, P 4.4. for oil filter change, P 4.6. for air filter change, P 4.8. for oil separator element, P 4.10. for motor service). Depress the ⓓ key to enter editing mode. The display will now show NO SET flashing. Use the ⓕ button to move to ”Set Time”. Use the Enter key to reset the service interval counter.
This function is disabled when the motor is running.

P 4.9. The motor service interval, i.e. bearing lubrication interval, is motor–specific. VS–Pilot will set the correct service interval automatically.
The service settings have the service interval for 1500 rpm motor speed. The service interval is different with different motor speeds and motors of different size. The service interval counter speeds up or slows down according to the motor speed so that the final service interval will be correct.

P 4.11. Service personnel authorized by Gardner Denver have the required password.

Discharge Temperature	AEON 2000 Change Interval	AEON 4000 Change Interval	AEON 9000 Change Interval
UP TO 180 F (82 C)	2000 hours	4000 hours	6000 hours *
180 F TO 190 F (82 C TO 88 C)	1500 hours	3000 hours	6000 hours
190 F TO 200 F (88 C TO 93 C)	1000 hours	2000 hours	4000 hours
200 F AND HIGHER (93 C)	500 hours	1000 hours	2000 hours

* Please note that the oil can operate for 8000 hours @ 180 F discharge temperature. However, the controller maximum oil life setting is 6000 hours.

Figure 2 Oil Change Interval

M5 Active Faults

The submenus of the Active Faults menu can be entered by depressing the right menu key (▷) from the Active Faults main menu M5.

If the compressor stops because of a fault, the display will show the symbol F accompanied by the serial number of the fault, the fault code, and a short description of the fault.

If several faults occur at the same time, the list of active faults can be scrolled using the scrolling keys (△, ▽).

The active faults list can hold 10 latest faults. To return to normal display depress the Reset key, and you will return back to the situation that existed before the fault. The active fault(s) will remain active until reset by depressing the Reset key (or by a reset signal from the terminal connector, this function can be activated from the machine settings with a parameter).

M5	
Active Faults	Normal situation
F0	no faults

The compressor controller identifies four different types of faults

A (Alarm) This fault type indicates deviations in the operating conditions. The compressor is not stopped, and no special action is required. A is shown on the display approx. 30 seconds after the conditions have returned to normal.

F (Fault) An F fault causes the compressor to stop. Action to remedy the fault is required before the compressor can be restarted.

AR (Automatic Reset of fault) When an AR fault occurs, the compressor will also stop at once. The fault is reset automatically and the controller will attempt to restart the motor. If restarting fails, it will finally lead to Fault Triggering (FT). This fault type includes example undervoltage and overvoltage.

FT (Fault Triggering) If the controller cannot restart the compressor after an AR fault, an FT fault will result. An FT fault stops the compressor.

When a fault occurs, the display will show the information described above. When the right menu key (▷) is depressed in this situation, you will enter a menu containing *Information registered at the moment of fault* occurrence with the symbols T.1 – T.13.

The menu contains the following information:

T.1	Power–on days (counting when power on, not equal to operating hours)	d
T.2	Power–on hours (counting when power on, not equal to operating hours)	hh:mm:ss
T.3	Output frequency	Hz
T.4	Motor current	A
T.5	Motor voltage	V
T.6	Relative value of motor power	%
T.7	Relative value of motor torque	%
T.8	DC voltage	V
T.9	Temperature of frequency converter heat sink	F
T.10	Operating mode	
T.11	Direction	
T.12	Warnings	
T.13	0 speed	

Fault Codes

Fault Code	Fault	Possible Cause	Action
1 (AR)	Overcurrent	Controller has detected high current (>4I_n) in motor supply cable. – sudden high increase in load – short–circuit in motor cable	– Check load – Check motor cable.
2 (AR)	Overvoltage	Voltage of DC link circuit has exceeded limit value – deceleration time too short – supply voltage surges	– Adjust deceleration time longer, or contact authorized Gardner Denver Service.
3 (F)	Ground fault	Current measurements indicate that the sum of the phase currents of motor output is not zero. – insulation fault in cables or motor	– Check motor cable and motor
5 (F)	Charging switch	Charging switch is open when RUN command comes – faulty operation – component fault	– Reset fault and restart the compressor, contact authorized Gardner Denver Service.

Fault Code	Fault	Possible Cause	Action
7 (F)	Saturation fault	Very high overload Faulty component	– Cannot be reset from controller. Switch off current. If fault persists, contact authorized Gardner Denver Service.
8 (F)	Unidentified fault	Troubleshooting system of compressor controller is unable to identify fault.	– Reset fault and restart compressor. If fault persists, contact authorized Gardner Denver Service.
9 (AR)	Undervoltage	Intermediate DC link voltage below defined limits. – too low supply voltage – internal fault in frequency converter	– Reset fault and restart compressor. Check supply voltage. If sufficient, internal fault is evident. Contact authorized Gardner Denver Service
10 (F)	Input line supervision	Supply phase missing.	– Check supply voltage and cable
11 (F)	Output phase supervision	Current measurements indicate that an output phase lacks current	– Check motor cable and motor.
13 (F)	Drive undertemperature	Heat sink temperature below 14 F	– Arrange heating, minimum temperature 32 F
14 (F or A)	Drive overtemperature	Heat sink temperature over 194 F Warning of high temperature is given when heat sink temperature exceeds 185 F	– Check cooling air circulation – Check cleanness of heat sink. – Check ambient temperature – Make sure that frequency is not too high considering ambient temperature and motor load.
15 (F)	Motor stalled	Motor jam protector tripped	– Check motor, contact authorized Gardner Denver Service.
16 (F)	Motor overtemperature	Motor temperature sensor has detected high motor temperature Motor overloaded	– Decrease motor load. If no overload, check motor temperature monitoring parameters, contact authorized Gardner Denver Service.
17 (F)	Motor underload	Belts broken	– Change belts

Fault Code	Fault	Possible Cause	Action
22 23 (F)	EEPROM check-sum fault	Parameter storage error – malfunction – component fault	
24 (F)	Warning of changed data	Due to power failure, changes may have occurred in different counter data.	– No special action required
25 (F)	Microprocessor watchdog	– malfunction – component fault	– Reset fault and restart. If fault persists, contact authorized Gardner Denver Service.
29 (F)	Thermistor protection	Thermistor tripped by motor overload	– Decrease motor load; lower pressure and/or maximum frequency.
37 (F)	Device replaced	Extra board replaced Different power ratings in device.	– Reset fault, contact authorized Gardner Denver Service.
38 (F)	Device added	Expansion board installed Device with different power ratings added.	– Reset fault, contact authorized Gardner Denver Service.
39 (F)	Device removed	Extra board removed Device removed.	– Reset fault, contact authorized Gardner Denver Service
40 (F)	Unidentified device	Unidentified extra board or device.	– Contact authorized Gardner Denver Service.
41 (F)	IGBT temperature	IGBT overheat protector has detected too high, short overcharging current.	– Check load – Check motor size.
50 (AR)	Pressure transducer fault	Analog input current <4 mA. – pressure transducer cable disconnected or damaged – signal source damaged	– Check pressure transducer and cable.
51 (F)	Emergency stop	Emergency stop device activated	– Reset red–yellow emergency stop device.
53 (A)	Field bus communication fault	Bus communication broken.	– Contact authorized Gardner Denver Service.
54 (A)	SPI communication fault	Communication between component and control board broken.	– Contact authorized Gardner Denver Service
55 (F)	Compressor overtemperature	– High ambient temperature – Cooler dirty	– Check ambient temperature – Clean cooler

Fault Code	Fault	Possible Cause	Action
56 (F)	Temperature sensor fault	Temperature sensor shorted or cable broken.	– Check temperature sensor – Check temperature sensor cable
57 (F)	Overpressure	Oil separator element clogged Output hose clogged Aftercooler frozen	– Check oil separator and/or output hose. – Check aftercooler.
58 (A)	Oil change	Oil change service interval counter has reached service alarm limit	– Change oil.
59 (A)	Oil filter change	Service interval counter for oil filter change has reached service alarm limit or differential pressure exceeding allowed limit.	– Replace oil filter
60 (A)	Air filter change	Service interval counter for air filter change has reached service alarm limit or differential pressure exceeding allowed limit.	– Replace air filter
61 (A)	Oil separator element change	Service interval counter for oil separator element change has reached service alarm limit or differential pressure exceeding allowed limit.	– Replace oil separator element.
62 (A)	Dryer alarm	Dew point temperature of built–in, optional drier has exceeded the allowed limit.	– Check drier – Check cooler. – Check operation of both.
63 (A or F)	Optional alarm or stop	Alarm from a device installed by customer	
64 (A)	Motor bearing service	Motor bearing service interval counter for has reached service alarm limit.	– Lubricate bearings.

M6 Fault History

Fault history shows the same error messages as the M5 menu (M5 Active Faults). The menu holds the latest 30 messages in storage.

M9 System Menu

The System Menu can be used for changing the controller language or checking the MWh counter, for instance.

Note! The counter for power–on days and hours is always running when power is switched on, even when the motor is stopped

The functions between codes S 9.3.1 and P 9.4.3 should not be changed.

Code	Function	Default	Options
S 9.1	Application	VS–Pilot	
S 9.2	Language		– English – Deutsch – Suomi – Svenska – Italiano – Français
S 9.3	System settings		P1 P7
S 9.3.1	Password	Not in use	0 = not in use
P 9.3.2	Parameter lock	Changes allowed	– changes allowed – changes not allowed
P 9.3.3	InternBrakeRes	Not connected	– not connected – connected
P 9.3.4	Fan control	Constant	– constant – temperature
P 9.3.5	Multimon. page	Changes allowed	– changes allowed – changes not allowed
P 9.3.6	HMI ACK timeout	200	
P 9.3.7	HMI retry	5	
S 9.4	Keypad settings		P1 P5
P 9.4.1	Default page		
P 9.4.2	Default page / OM		
P 9.4.3	Timeout time	30	
P 9.4.4	Contrast	18	
P 9.4.5	Backlight time	10	

Code	Function	Default	Options
S 9.5	Copy Parameters		P1 P4
S 9.5.1	Up to keypad		– all parameters
S 9.5.2	Down keypad		– all parameters – application parameters
S 9.5.3	Parameter sets		– save settings 1 – load settings 1 – save settings 2 – load settings 2
P 9.5.4	Param.BackUp	No	– yes – no
S 9.6	ParamComparison		
S 9.6.1	Set 1	Not in use	
S 9.6.2	Set 2	Not in use	
S 9.6.3	Factory settings		P1 P20
S 9.6.4	Keypad set		P1 P2
S 9.7	Info		I1 I7
I 9.7.1	Power unit		
I 9.7.2	Unit voltage		
I 9.7.3	Software version		
I 9.7.4	Firmware interf.		
S 9.7.5	Expanders		
S 9.7.6	Applications		
S 9.7.7	Debug		
S 9.8	Counters		C1 C3
C 9.8.1	MWh counter		
C 9.8.2	OpDayCounter		
C 9.8.3	Op.hour counter		
S 9.9	Trip counters		T1 T5
T 9.9.1	MWh counter		
P 9.9.2	Clr MWh Counter		
T 9.9.3	Op Day Counter		
T 9.9.4	Op.hour counter		
P 9.9.5	Clr Optime cntr		

Operation with other Compressors

The VS–Pilot will function well with other compressors controlled by AUTO SENTRY ES+, RS2000, or AIRPILOT+ controllers. For operation as a system, pipe all compressors into a common header and provide adequate air storage volume to minimize starting and stopping during transient demands. The companion packages should be less than 80% capacity of the VS–Pilot for stable operation. This may be a single compressor package, or a group of packages operating as a sequenced system. Refer to the AUTO SENTRY Operating Instructions for a complete description of the sequencing operation.

When used with a package controlled with an AUTO SENTRY ES+ controller, set its ”IV CONTROL MODE” to ”LOAD/UNLOAD”. When used with RS2000, or AIRPILOT+ controllers, adjust their pilot controls (if present) so that the packages run in load/unload mode. This ensures that the variable speed package will always serve as a trim unit, and the companions will always be used in their most efficient modes. Besides improving efficiency, the variable speed unit also reduces the number of starts and stops of the base load unit(s).

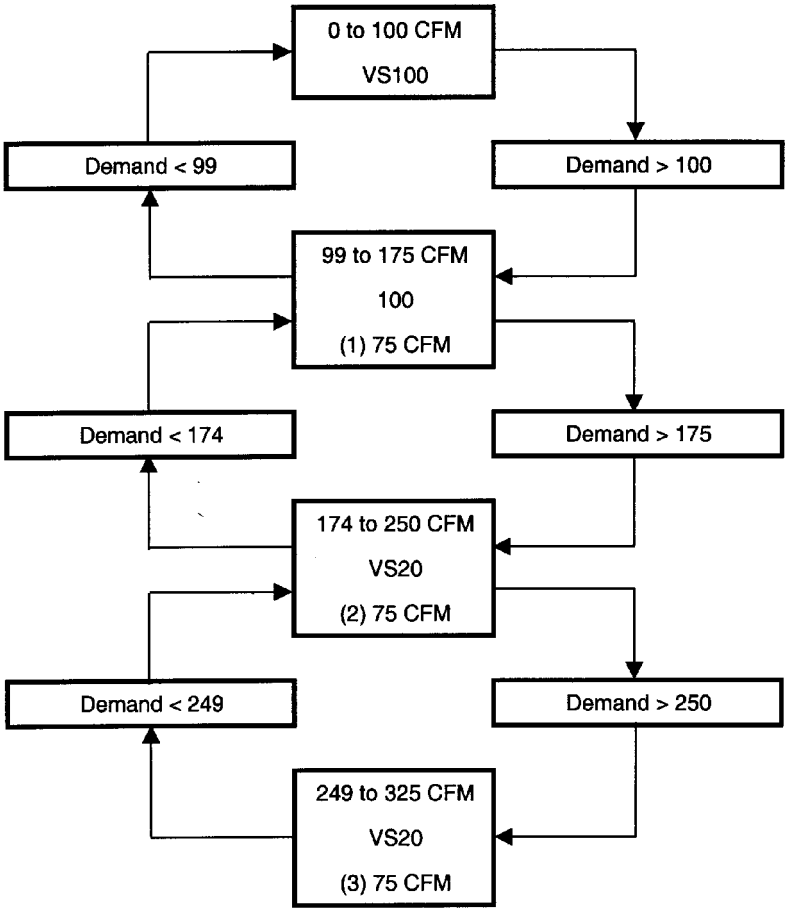
Adjust the ”RESET PRESSURE” or ”LOAD PRESSURE” of the companion unit(s) to 1–2 psi above the minimum desired pressure. The air storage will service any increase in demand when the pressure drops below this, and added units are started. Adjust the ”SET PRESSURE” or ”UNLOAD PRESSURE” of a single companion unit to 1–2 psi below the maximum desired pressure, or sequenced units equal to the maximum. Adjust the target pressure of the VS–Pilot to the midpoint of these two pressures. The ”SET PRESSURE” or the ”UNLOAD PRESSURE” must be under the VS–Pilot’s stopping pressure (target pressure+7 PSI).

The VS–Pilot will always attempt to match delivery to the demand, and maintain pressure near the center of the programmed pressure band. If its range is exceeded, an additional base load unit will automatically be added or unloaded, and the VS–Pilot will once again be able to maintain the flow and pressure.

For example, imagine a system requiring 85–100 psig, 0–600 CFM. This will be served with a single variable–speed unit rated 400 CFM, and three RS2000 controlled units rated 300 CFM each. The RS2000 units are adjusted to 90/100 psig and operated in sequence. The variable–speed package is adjusted to 95/105 psig. Figure 3, page 17, illustrates the operation of this system for all demands from 0 to 1300 CFM. While operating in any of the stable states in the center column, the VS–Pilot will continuously adjust its delivery to maintain a ”cruising” pressure of 95 psig. If its range is exceeded, the pressure falls to 90 psig and another base unit is added. If the demand drops below the range in one of these states, the pressure rises towards 100 psig, and a base unit is unloaded. Note that there is about 25 CFM difference in the loading and unloading flows to prevent short–cycling of base units if the demand is hovering near a step.

As with any good design, a complete analysis of the compressor room’s demands must be done before specifying the packages. The variable speed package maintains excellent operating efficiency, and eliminates the frequent pressure fluctuations of a traditional load/unload system. Note that the growth capability is also provided, as another base unit may simply be added to the sequence deck for reserve or for increased demand.

The VS–Pilot may be used with other compressor types or non–cascading systems in a similar manner. Refer to the manufacturer’s instructions for setup and adjustment.



VS20 Target pressure=95

(3) Sequenced RS2000, Load/unload, Pset=100, Pres=90

Figure 3 Multi Unit Flow Chart

Connection to External Controls

The VS–Pilot controller offers interconnection points for external controls and indicators. This allows simple connection to remote controls and indicators, or integration into any plant–wide controls system.

WARNING

Automatic restarting or electrical shock can cause injury or death. Open and lock main disconnect and any other circuits before servicing unit.

Remote control is installed by removing the jumper between the terminal connectors 1 and 6 and then connecting the remote control switch to these terminals.

After this, when you depress the START key on the controller, the remote control switch is open and the compressor is ready for remote control. The display Status (V 1.1) shows REMOTE READY. When the remote control switch is then closed, the compressor will start and the display reads: Status RUN

The compressor must always be first activated by depressing the START key.

Alarm Relay

The VS–Pilot controller is provided with an alarm relay which may be connected to a remote mounted indicator light, horn, or into a PLC input of a plant–wide control system. The relay is turned on whenever power is on and there are no active faults. It is turned off when there is a fault condition requiring service at the compressor, or power off conditions. The external connections from the controller are from an isolated form C (single–pole, double–throw) contact. This allows control of either a ”compressor okay” or a ”compressor shutdown” remote indicator.

To use this relay, connect the supply wire for the remote circuit to terminal 60 (relay common) on the terminal strip. Connect a wire to the indicator from either terminal 61 (normally open) or from terminal 62 (normally closed). Connect the other side of the indicator to its neutral.

Wiring Diagrams

Refer to the wiring diagram with the spare part lists, pages 38 to 44.

Limiting Function

The VS–Pilot controller has a built–in limiting function for max. and min. output, if the compressor is used in exceptional circumstances

Current Limiting:
If motor current exceeds the constant maximum current for the motor or the frequency converter, the maximum frequency is limited or the minimum frequency is raised until current is within a safe range.
Possible causes: Low voltage or clogged filters.

Frequency Converter Protection:
If the temperature of the frequency converter heat sink rises over the allowed limit, the maximum or minimum frequency is limited until the temperature drops to a safe value.
Possible causes: Overload, dirt, or high ambient temperature.

Motor Protection:
If the compressor is running at maximum capacity and the ambient temperature is above 40 C, the maximum capacity is limited to approx. 90%. The compressor can now be operated in ambient temperatures up to 113 F.
The minimum capacity can be used for raising the minimum speed of rotation in order to improve the cooling of the motor in temperatures exceeding 104 F.

The limiting function may be activated if the cooler is dirty.

Auto Restart After Power Failure

The VS–Pilot controller normally displays ”Stop” after power has been interrupted and restored. Press the green start button to restart compressor operation.

If programmed for automatic restart, the VS–Pilot will recall what it had been doing prior to the interruption. If it was manually stopped or faulted prior to the interruption, it will display ”Stop” after power has been interrupted and restored. Press the green start button to restart compressor operation. If the compressor was operating prior to the interruption (whether running or standby), it will proceed to place itself back into operation.

The VS–Pilot controller first pauses to ensure that power is completely restored and stable. This time is 12 seconds. After the pause is complete, the VS–Pilot controller resumes automatic operation.

Compressor Settings

Description of Display	Adjusting Range	Description of Function, Factory Setting
Max Pressure	43.5 – 217.5 psi	Compressor maximum pressure
Start difference	0 – 14.5 psi	Starting pressure difference from regulated pressure, 0 psi
Stop difference	4.4 – 14.5 psi	Stopping pressure difference from regulated pressure, 7.3 psi
Start time	0 – 30 s	Starting time keeps minimum frequency during starting, 2 s
Drain rounds	100 – 6000 rpm	Condensate removal interval measured in rotation speed of motor, 3000 rpm
DelAirAlarmLimit	194 – 230 F	Compressor alarm temperature 212 F
DelAirShutDownLimit	Fixed	Compressor stop temperature 240 F
DisplayEntryTime	10 – 300 s	Display returns to pressure reading (V 1.2), 30 s

Input Settings

Description of Display	Connection	Description of Function
DIN 4 OptionStop	Terminal connectors 5 and 8	Normally closed contacts connected to input give stopping alarm immediately.
DIN 5 OptionAlarm	Terminal connectors 3 and 9	Normally open contacts give alarm (service alarm AR). Contacts shall remain closed for 30 seconds before the alarm becomes active.
DIN 6 DryerAlarm	Terminal connectors 5 and 10	Compressor equipped with dryer. Dryer temperature measuring board will give an alarm if the dryer's dew point temperature exceeds the alarm limit. The alarm shall be on for 30 seconds and the motor shall be running, before the frequency converter will register the alarm.

Gardner Denver

22.09.2003

EGB
Startup and Maintenance – Variable Speed Package Date:

Company Name: _____

Address: _____

. _____

. _____

Machine S/N:_____ Machine Model:_____

Package nameplate:	Box nameplate:	VSD nameplate:
Code:_____	Drwg#_____	Type:_____
Year:_____	Date:_____	Sno:_____
Capacity: _____ CFM	Volt:_____V	Input:_____V
Max Press:_____ PSI	Freq:_____Hz	I1: _____A
Speed:_____ RPM	FL Cur:_____A	P1: _____KW
ElSupply:_____ V/H	MainMtr:_____A	IP:_____Type:_____

Main Motor Nameplate:	Fan Motor Nameplate (if applicable):
Motor Mfg:_____	Motor Mfg: _____
Serial No:_____	Serial No: _____
Model:_____	Model: _____
Nominal : 400V 87Hz_____	Nominal : _____
KW:_____ RPM:_____ A:_____	KW:_____ RPM:_____ A:_____

Check off the following, note any comments or deviations.

☐ 1– Application: What is the targeted pressure band?_____
Note other packages to co–ordinate, other control issues.

☐ 2– Overall inspection of package – repair as needed and take notes
- ☐ Overall appearance and condition of unit is good, except as noted.
- ☐ Ample space is provided around the compressor for air circulation, maintenance, and repairs.
- ☐ Surface supports the weight of the compressor
- ☐ Floor makes 100% contact with rails of compressor base
- ☐ Hold down bolts/capscrews properly torqued
- ☐ All pipe fittings and connections checked
- ☐ Pressure relief valve(s) installed where needed and properly sized
- ☐ Inlet piping is properly sized, inspected, and cleaned
- ☐ Inlet or air filter is properly sized and assembled
- ☐ Oil is filled to proper level
- ☐ Check for current operating manual, parts list, wiring diagrams

☐ 3– Water cooled units only
- ☐ Water shutoff valve installed
- ☐ Inlet water temperature between 60–90 DegF
- ☐ Piping sized for adequate flow rate
- ☐ Water PSIG between 40–75 PSIG at full flow rate
- ☐ Discharge water temperature=_____ DegF

☐ 4– Electrical Connections
- ☐ Wiring checked per print and machine properly grounded
- ☐ All connections checked for tightness and good contact

☐ 5– Check airend sheave for proper drive ratio:
VS 110 (VS 20)

100 psig – 250/132 (9.8/5.2 in dia)	150 psig – 250/160 (9.8/6.3 in dia)
125 psig – 250/150 (9.8/5.9 in dia)	175 psig – 212/150 (8.3/5.9 in dia)

☐ 6– Record all adjustments and history from the VS–Pilot – initial

☐ 7– Check all adjustments against recommended settings

☐ 8– Adjust VS–Pilot Oil Change Interval for the Oil used:

AEON 2000	2000 hours
AEON 4000	4000 hours
AEON 6000FG	4000 hours
AEON 9000	6000 hours
AEON BIO	6000 hours

☐ 9– There is two kinds of separator temperature sensor voltage measurement devices, component U3, with display or without display (open electric cabinet door and find component market with label U3). If U3 does not have display there is no need to do more checkings. If U3 has display check voltage value Ib. Voltage should be between Ib=2.7 – 3.5V at cold machine at ambient 32 – 104F temperature and under 4.2V at warm machine. If voltage value is not visible and text ”STOP” is visible on display follow at tached ”Separator temperature measurement device setting” procedure.

☐ 10– Only for units with a separate fan motor : Check fan rotation between 5–60 seconds after start. Check that air flows up (not down) through cooler. Swap two phases at fan line contactor if required.

☐ 11– Start compressor. Check overall pressure stability after flow change

☐ 12– Record all adjustments and history from the VS–Pilot–final

☐ 13– Describe application and installation conditions

☐ 14– Record measurements while stopped, light demand and heavy demand

☐ 15– Review the installation with owner personnel
- ☐ Correct operating procedures
- ☐ Safety precautions
- ☐ Recommended routine maintenance
- ☐ Controller adjustments
- ☐ Review sections of operating manual, parts list, wiring diagrams
- ☐ Leave a set of manuals and diagrams at the compressor
- ☐ Recommend Evacuator instead of timed drain

Started by: _____

Company Represented: _____

Customer contact: _____

Phone: _____

Owner Signature: _____

5, 6, 7, 8, 12 – VS–Pilot Adjustments

M6 Fault history

H6.1 _____
H6.2 _____
H6.3 _____
H6.4 _____
H6.5 _____
H6.6 _____
H6.7 _____
H6.8 _____
H6.9 _____
H6.10 _____
H6.11 _____
H6.12 _____
H6.13 _____
H6.14 _____
H6.15 _____
H6.16 _____
H6.17 _____
H6.18 _____
H6.19 _____
H6.20 _____
H6.21 _____
H6.22 _____
H6.23 _____
H6.24 _____
H6.25 _____
H6.26 _____
H6.27 _____
H6.28 _____
H6.29 _____
H6.30 _____

Timers (M2 Monitor)

V2.6. Running hours		_____
V2.7. RunHourFactor		_____
V2.8. Oil Change Time	OilChange–run hrs	_____
V2.9. Oil Filter Change	1000h–run hrs	_____
V2.10. Air Filter Change	1500–run hrs	_____
V2.11. OilSepChanTime	4000–run hr	_____
V2.12. MotorServTime		_____

Pressure setting (M2 Monitor)

P2.3 Target Pressure	_____

M3 Operat.settings

P3.1 Auto Start	Off
P3.2 Unit Measure	English
P3.3 Compressor Model	VS20 USA
P3.4 Machine Password	0

M4 Service settings

P4.1 OilChangInterval	OilChange
P4.2 SetOilChangTime	No Set
P4.3 OilFiltChanInter	1000h
P4.4 SetOilFilterTime	No Set
P4.5 AirFiltChanInter	1500h
P4.6 SetAirFiltTime	No Set
P4.7 OilSepChanInter	4000h
P4.8 SetOilSepTime	No Set
P4.9 MotorServicInter	8500h
P4.10 MotorServiceSet	No Set
P4.11 Service Password	0 (314)

9 Separator temperature measurement device setting

1. Press [Sel/OK] button
2. Press [esc] button (cursor should now blink on TIME SET on text WINTER)
3. Press [Sel/OK] button repeatedly until cursor comes back to text ”WINTER” or ”SUMMER” and this text is not blinking.
4. Press [esc] button twice
5. Press [Sel/OK] button
6. Press [z1] or [z3] repeatedly until the cursor points blinking text ”RUN/STOP”
7. Press [Sel/OK] button
8. Now cursor should point text ”YES”. Press [Sel/OK] button
9. Now cursor should point blinking text ”RUN/STOP”
10. Press [esc.] button and Ib voltage value should be visible. When lb value is visible device is ready and operating. If lb value is not visible follow TIME SET instruc tions and continue from item 5.

TIME SET instructions

1. Press [esc] button twice
2. Press [Sel/OK] button
3. Press [z1] or [z3] repeatedly until the cursor points blinking text ”TIME SET”
4. Press [Sel/OK] button (cursor should now blink on ”TIME SET” on text WINTER).
5. Press [Sel/OK] button repeatedly until cursor comes back to text ”WINTER” or ”SUMMER” and this text is not blinking.
6. Press [esc] button twice

14–Record	off	light demand	heavy demand
Vab	_____V rms	_____V rms	_____V rms
Vbc	_____V rms	_____V rms	_____V rms
Vca	_____V rms	_____V rms	_____V rms
Ia		_____A rms	_____A rms
Ib		_____A rms	_____A rms
Ic		_____A rms	_____A rms
V2.1 Operate mode		_____	_____
V2.2 Pressure	_____PSIG	_____PSIG	_____PSIG
V2.4 Compressor Temp	_____DegF	_____DegF	_____DegF
V2.5 Capacity		_____%	_____%
V2.13 Output frequency		_____Hertz	_____Hertz
V2.14 Motor speed		_____RPM	_____RPM
V2.15 Motor current		_____Amps	_____Amps
V2.16 Motor voltage		_____Volts	_____Volts
V2.17 DC–link voltage	_____Volts	_____Volts	_____Volts
V2.18 Heat Sink Temp	_____ C	_____ C	_____ C
V2.19 Software Version		_____	_____
Ambient Temp	_____DegF	_____DegF	_____DegF

EGC
Startup and Maintenance – Variable Speed Package Date:

Company Name: _____

Address: _____

. _____

. _____

Machine S/N:_____ Machine Model:_____

Package nameplate:	Box nameplate:	VSD nameplate:
Code:_____	Drwg#_____	Type:_____
Year:_____	Date:_____	Sno:_____
Capacity: _____ CFM	Volt:_____V	Input:_____V
Max Press:_____ PSI	Freq:_____Hz	I1: _____A
Speed:_____ RPM	FL Cur:_____A	P1: _____KW
ElSupply:_____ V/H	MainMtr:_____A	IP:_____Type:_____

Main Motor Nameplate:	Fan Motor Nameplate (if applicable):
Motor Mfg:_____	Motor Mfg: _____
Serial No:_____	Serial No: _____
Model:_____	Model: _____
Nominal : 400V 87Hz_____	Nominal : _____
KW:_____ RPM:_____ A:_____	KW:_____ RPM:_____ A:_____

Check off the following, note any comments or deviations.

☐ 1– Application: What is the targeted pressure band?_____
Note other packages to co–ordinate, other control issues.

☐ 2– Overall inspection of package – repair as needed and take notes
- ☐ Overall appearance and condition of unit is good, except as noted.
- ☐ Ample space is provided around the compressor for air circulation, maintenance, and repairs.
- ☐ Surface supports the weight of the compressor
- ☐ Floor makes 100% contact with rails of compressor base
- ☐ Hold down bolts/capscrews properly torqued
- ☐ All pipe fittings and connections checked
- ☐ Pressure relief valve(s) installed where needed and properly sized
- ☐ Inlet piping is properly sized, inspected, and cleaned
- ☐ Inlet or air filter is properly sized and assembled
- ☐ Oil is filled to proper level
- ☐ Check for current operating manual, parts list, wiring diagrams

☐ 3– Water cooled units only
- ☐ Water shutoff valve installed
- ☐ Inlet water temperature between 60–90 DegF
- ☐ Piping sized for adequate flow rate
- ☐ Water PSIG between 40–75 PSIG at full flow rate
- ☐ Discharge water temperature=_____ DegF

☐ 4– Electrical Connections
- ☐ Wiring checked per print and machine properly grounded
- ☐ All connections checked for tightness and good contact

☐ 5– Check airend sheave for proper drive ratio:
VS 240 (VS 40)

100 psig – 250/132 (9.8/5.2 in dia)	150 psig – 236/140 (9.3/5.5 in dia)
125 psig – 250/132 (9.8/5.2 in dia)	175 psig – 236/150 (9.3/5.9 in dia)

☐ 6– Record all adjustments and history from the VS–Pilot – initial

☐ 7– Check all adjustments against recommended settings

☐ 8– Adjust VS–Pilot Oil Change Interval for the Oil used:

AEON 2000	2000 hours
AEON 4000	4000 hours
AEON 6000FG	4000 hours
AEON 9000	6000 hours
AEON BIO	6000 hours

☐ 9– There is two kinds of separator temperature sensor voltage measurement devices, component U3, with display or without display (open electric cabinet door and find component market with label U3). If U3 does not have display there is no need to do more checkings. If U3 has display check voltage value Ib. Voltage should be between Ib=2.7 – 3.5V at cold machine at ambient 32 – 104F temperature and under 4.2V at warm machine. If voltage value is not visible and text ”STOP” is visible on display follow at tached ”Separator temperature measurement device setting” procedure.

☐ 10– Only for units with a separate fan motor : Check fan rotation between 5–60 seconds after start. Check that air flows up (not down) through cooler. Swap two phases at fan line contactor if required.

☐ 11– Start compressor. Check overall pressure stability after flow change

☐ 12– Record all adjustments and history from the VS–Pilot–final

☐ 13– Describe application and installation conditions

☐ 14– Record measurements while stopped, light demand and heavy demand

☐ 15– Review the installation with owner personnel
- ☐ Correct operating procedures
- ☐ Safety precautions
- ☐ Recommended routine maintenance
- ☐ Controller adjustments
- ☐ Review sections of operating manual, parts list, wiring diagrams
- ☐ Leave a set of manuals and diagrams at the compressor
- ☐ Recommend Evacuator instead of timed drain

Started by: _____

Company Represented: _____

Customer contact: _____

Phone: _____

Owner Signature: _____

5, 6, 7, 8, 12 – VS–Pilot Adjustments

M6 Fault history	H6.1	_____
	H6.2	_____
	H6.3	_____
	H6.4	_____
	H6.5	_____
	H6.6	_____
	H6.7	_____
	H6.8	_____
	H6.9	_____
	H6.10	_____
	H6.11	_____
	H6.12	_____
	H6.13	_____
	H6.14	_____
	H6.15	_____
	H6.16	_____
	H6.17	_____
	H6.18	_____
	H6.19	_____
	H6.20	_____
	H6.21	_____
	H6.22	_____
	H6.23	_____
	H6.24	_____
	H6.25	_____
	H6.26	_____
	H6.27	_____
	H6.28	_____
	H6.29	_____
	H6.30	_____

Timers (M2 Monitor)

V2.6. Running hours		_____
V2.7. RunHourFactor		_____
V2.8. Oil Change Time	OilChange–run hrs	_____
V2.9. Oil Filter Change	1000h–run hrs	_____
V2.10. Air Filter Change	1500–run hrs	_____
V2.11. OilSepChanTime	4000–run hr	_____
V2.12. MotorServTime		_____

Pressure setting (M2 Monitor)

P2.3 Target Pressure	_____

M3 Operat.settings

P3.1 Auto Start	Off
P3.2 Unit Measure	English
P3.3 Compressor Model	VS40 USA
P3.4 Machine Password	0

M4 Service settings

P4.1 OilChangInterval	OilChange
P4.2 SetOilChangTime	No Set
P4.3 OilFiltChanInter	1000h
P4.4 SetOilFilterTime	No Set
P4.5 AirFiltChanInter	1500h
P4.6 SetAirFiltTime	No Set
P4.7 OilSepChanInter	4000h
P4.8 SetOilSepTime	No Set
P4.9 MotorServicInter	6500h
P4.10 MotorServiceSet	No Set
P4.11 Service Password	0 (314)

9 Separator temperature measurement device setting

1. Press [Sel/OK] button
2. Press [esc] button (cursor should now blink on TIME SET on text WINTER)
3. Press [Sel/OK] button repeatedly until cursor comes back to text ”WINTER” or ”SUMMER” and this text is not blinking.
4. Press [esc] button twice
5. Press [Sel/OK] button
6. Press [z1] or [z3] repeatedly until the cursor points blinking text ”RUN/STOP”
7. Press [Sel/OK] button
8. Now cursor should point text ”YES”. Press [Sel/OK] button
9. Now cursor should point blinking text ”RUN/STOP”
10. Press [esc.] button and Ib voltage value should be visible. When lb value is visible device is ready and operating. If lb value is not visible follow TIME SET instruc tions and continue from item 5.

TIME SET instructions

1. Press [esc] button twice
2. Press [Sel/OK] button
3. Press [z1] or [z3] repeatedly until the cursor points blinking text ”TIME SET”
4. Press [Sel/OK] button (cursor should now blink on ”TIME SET” on text WINTER).
5. Press [Sel/OK] button repeatedly until cursor comes back to text ”WINTER” or ”SUMMER” and this text is not blinking.
6. Press [esc] button twice

14–Record	off	light demand	heavy demand
Vab	_____V rms	_____V rms	_____V rms
Vbc	_____V rms	_____V rms	_____V rms
Vca	_____V rms	_____V rms	_____V rms
Ia		_____A rms	_____A rms
Ib		_____A rms	_____A rms
Ic		_____A rms	_____A rms
V2.1 Operate mode		_____	_____
V2.2 Pressure	_____PSIG	_____PSIG	_____PSIG
V2.4 Compressor Temp	_____DegF	_____DegF	_____DegF
V2.5 Capacity		_____%	_____%
V2.13 Output frequency		_____Hertz	_____Hertz
V2.14 Motor speed		_____RPM	_____RPM
V2.15 Motor current		_____Amps	_____Amps
V2.16 Motor voltage		_____Volts	_____Volts
V2.17 DC–link voltage	_____Volts	_____Volts	_____Volts
V2.18 Heat Sink Temp	_____ C	_____ C	_____ C
V2.19 Software Version		_____	_____
Ambient Temp	_____DegF	_____DegF	_____DegF

Notes: