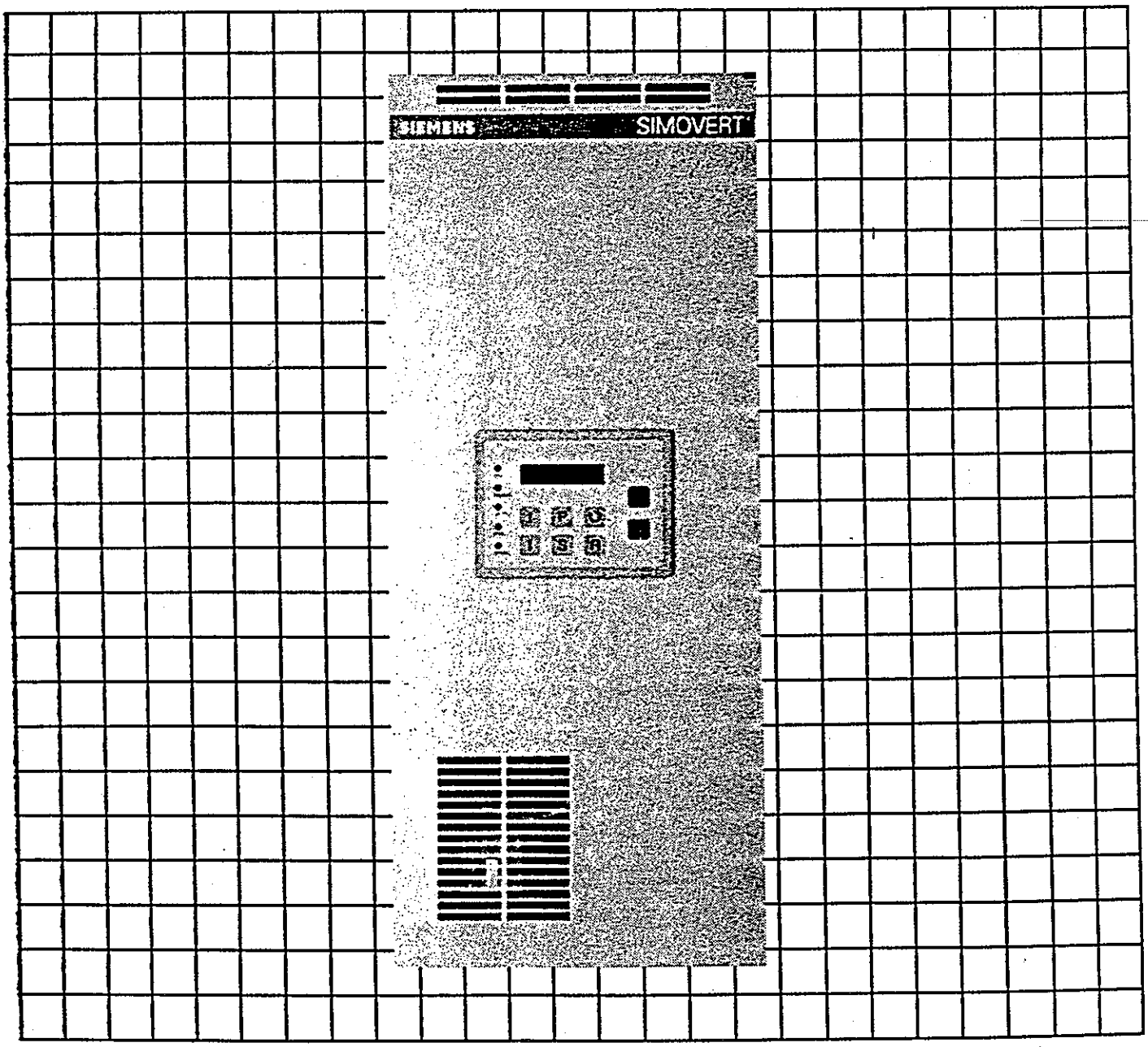
SIEMENS

Drom 80025

Adjustable Frequency Control for Single and Multi-Motor Applications

SIMOVERT® P Drive Controllers Series 6SE12

Installation & Operation Manual



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SIMOVERT P 6SE12

INSTRUCTION MANUAL

FEBRUARY 1994

This manual applies to Simovert-P type 6SE12 software version 3.3 .
There are some discrepancies between this manual and older software versions. Refer to Appendix C for a list of changes / discrepancies.

(continued on next page)

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NOTE

These instructions do not purport to cover all details or variations in equipment, nor to provide for every possible contingency to be met in connection with installation, operation, or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to the local Siemens sales office.

The contents of this instruction manual shall not become part of or modify any prior or existing agreement, commitment, or relationship. The sales contract contains the entire obligation of Siemens Motors & Drives Division. The warranty contained in the contract between the parties is the sole warranty of Siemens Motors & Drives Division.
Any statements contained herein do not create new warranties or modify the existing warranty.

⚠ WARNING

This equipment contains hazardous voltages and hazardous rotating mechanical parts. Loss of life, severe personal injury or property damage can result if instructions contained in this manual are not followed.

Only qualified personnel should work on this equipment, and only after becoming familiar with all safety notices, installation, operation and maintenance procedures contained in this manual. The successful and safe operation of this equipment is dependent upon proper handling, installation, operation and maintenance of the equipment.

Definitions

Qualified Person:

For the purpose of this manual and product labels, a QUALIFIED PERSON is one who is familiar with the installation, construction, operation and maintenance of this equipment, and the hazards involved. In addition, the person must have the following qualifications:

1. Is trained and authorized to energize, de-energize, clear, ground and tag circuits and equipment in accordance with established safety practices.
2. Is trained in the proper care and use of protective equipment such as rubber gloves, hard hat, safety glasses or face shields, flash clothing, etc., in accordance with established safety practices.
3. Is trained in rendering first aid.

Danger:

For the purpose of this manual and product labels, DANGER indicates loss of life, severe personal injury or substantial property damage WILL result if proper precautions are not taken.

Warning:

For the purpose of this manual and product labels, WARNING indicates loss of life, severe personal injury or substantial property damage CAN result if proper precautions are not taken.

Caution:

For the purpose of this manual and product labels, CAUTION indicates minor personal injury or property damage can result if proper precautions are not taken.

Note:

For the purpose of this manual, NOTES merely call attention to information that is especially significant in understanding and operating the drive.

⚠ DANGER

Hazardous voltages are used in the operation of this equipment, and will cause severe personal injury or loss of life. The following precautions should be followed to reduce risk of injury or death.

1. Only qualified personnel familiar with this equipment and the information supplied with it should be permitted to install, operate, troubleshoot or repair the apparatus.
2. Installation of the equipment must be done in accordance with the National Electrical Code and any other state or local codes. Proper grounding, conductor sizing and short circuit protection must be installed for safe operation.
3. During normal operation, keep all covers in place and cabinet doors shut.
4. When performing visual inspections and maintenance, be sure the incoming AC feed is turned off and locked out. The drive and motor will have hazardous voltages present until the AC feed is turned off.
5. When it is necessary to make measurements with the power turned on, do not touch any electrical connection points. Remove all jewelry from wrists and fingers. Make sure test equipment is in good, safe operating condition.
6. While servicing with the power on, stand on some type of insulation, being sure not to be grounded.
7. Follow the instructions given in this manual carefully and observe all danger, warning and caution notices.
8. This list does not represent an exhaustive survey of the steps necessary to insure safe operation of the equipment. Should further information be desired, or should particular problems arise which are not covered sufficiently for the purchasers' purposes, the matter should be referred to the local Siemens sales office.

General Safety and Caution Information

6SE12 Simovert-P inverters are power electronic devices that operate at high voltages. Up to 850 V is present inside the units and on devices and accessories connected to the units.

The inverter door should not be opened until after the AC line voltage is switched off. For reasons of safety, do not reach into the partially accessible interior of the drive controller.

High voltage may still be present for a short time on the DC link capacitors after the incoming AC power is turned off. The inverter door must therefore not be opened until 5 minutes after the AC line voltage has been disconnected from the unit.

When working on the opened unit is necessary, note that live parts are exposed. Appropriate measures must therefore be taken to insure that these live parts are not touched.

In the final installation, the chassis units must be installed in enclosed electrical areas to prevent accidental contact with live parts. The user must provide the required protection against contact as required by the National Electrical Code and applicable local codes.

The inverter must not be connected to an AC line with current-operated ground-fault circuit interrupters.

With models of the 6SE12 Simovert-P with Pulsed Resistor Braking, it should be noted that the Braking Resistor unit can reach high temperatures. For this reason, the inverter and the Braking Resistor Unit should be mounted in a location free from flammable substances and where personnel cannot contact the hot surfaces.

Internal and External Braking Resistors, in addition to being thermally hot, also operate at high voltages - 850 volts ! All of the safety precautions described previously for equipment inside the 6SE12 Simovert-P apply equally to External Braking Resistors and their associated wiring. External Braking Resistors remain electrically "live" for several minutes after power is removed from the 6SE12 Simovert-P, until the DC Link Capacitors discharge.

The Control Modules (printed circuit boards) in the 6SE12 Simovert-P contain elements that can be damaged by static discharge and electric fields. These modules should not be touched unless service personnel are properly grounded using a protective, grounding wrist strap and/or other "ESD" (ElectroStatic Discharge) precautions.

6SE12 Simovert-P variable speed AC drives are current controlled, voltage source inverters. They provide accurate, low-loss speed control of 3-phase induction motors.

The inverter provides the correct current, voltage, and frequency to the motor based on the load conditions and the user's command or "setpoint". A microprocessor based Control Module provides any of several selectable control modes including: voltage, "flux vector", speed, and torque control modes.

A very responsive and unique PWM current controller provides optimum sinusoidal motor current waveforms with low distortion and low harmonic content. This results in smooth, quiet, and efficient motor operation.

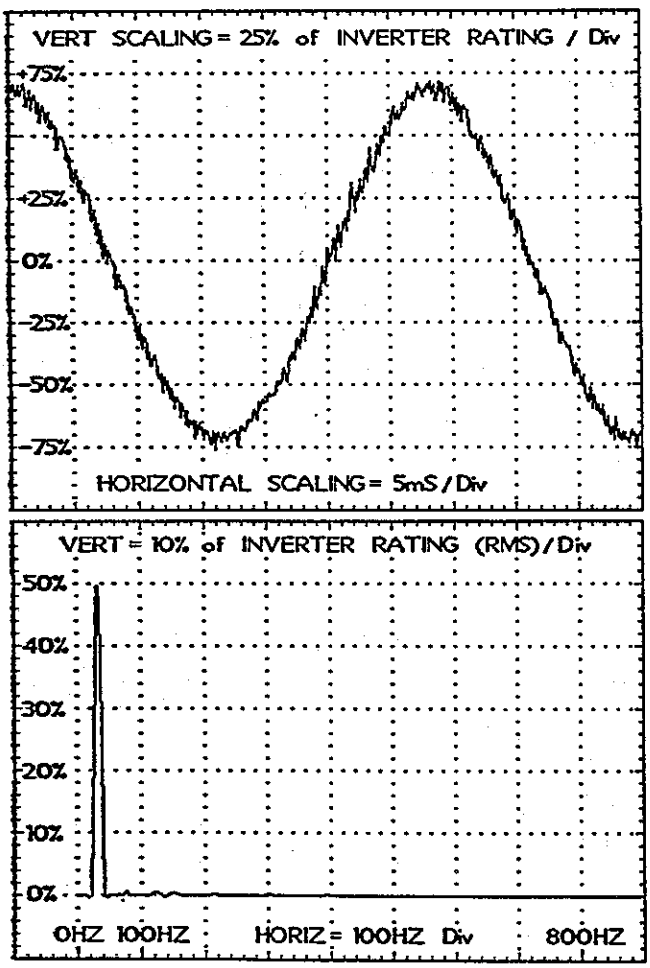


FIGURE 1.1 Typical Output Current
(time & spectrum plots @ 30Hz, 50% load)

Referring to figure 1.4 or 1.5 (on pages 1-9 & 1-10), the AC line voltage supplied to the 6SE12 Simovert-P is rectified by a three phase diode bridge. The resulting DC link voltage is then filtered with a bank of capacitors.

A power transistor inverter produces a three-phase, variable voltage, variable frequency, AC output for the motor(s) from the DC link.

A "field-oriented vector control technique" is implemented with a 16-bit microprocessor. A 3-phase current controller on the Control Module supplies commands to the inverter power transistors.

With the most frequently used "vector control" method, the motor speed is calculated, and it is therefore not necessary to measure the actual motor speed with a tachometer or pulse generator. A tachometer is also <u>not</u> required when the "V/Hz" control method is selected. Speed and torque control methods do require a tachometer.

The very accurate and responsive PWM current control technique allows output frequencies to be set as low as desired (even 0 Hz, DC) without the imbalance and offset effects present in other inverter types. This results in smooth operation even at low speeds and also reduces motor heating.

To adjust to the specific requirements of an application, the magnetization current of the motor may be increased or reduced relative to the rated magnetization current. This can be used to produce high starting torques (for high inertia or constant torque loads) or quiet and efficient operation at partial loads (for operation of pumps and fans).

(continued on next page)

Operating Fundamentals (continued)

The inverter can be controlled from a built-in operator/display panel located in the unit door, through terminal block inputs, or by a serial interface.

When used in a coordinated drive application the inverter control and setpoint determination can be made using optional serial interface or Technology Modules (option boards).

For general applications, it is merely necessary to enter the motor nameplate information via the operator panel to adapt the inverter to the specific motor it is powering.

For more complex applications requiring direct control of motor speed, a tachometer may be connected for closed loop speed control. Option Modules are available to implement Torque Control, Winder Functions, Coordinated Drives, and other applications. See Note 1 →

6SE12 Simovert-P models with Pulsed Resistor Braking (optional) allow the motor to produce braking torque and operate as a generator. In this case the energy supplied to the inverter by the motor is converted into heat in resistor(s). See note 2 →

For applications where one drive is "motoring" while others are "braking", terminals are provided to interconnect the DC Links. This allows full braking capability with minimal, or no, Pulsed Resistor. This technique is more energy efficient than using Pulsed Resistors on individual inverters. An example application is a winder / unwinder. The engineering and safety aspects of this approach are beyond the scope of this Instruction Manual. Do not attempt to implement this without consulting an experienced engineer. Contact a local Siemens Sales Office or see section 7.7 for Siemens Technical Assistance information.

The 6SE12 Simovert-P can be setup for various applications such as:

1) Single induction motor with frequency control. This is "Flux Vector Controlled" operation without a tachometer.

2) Multi-induction or synchronous motors with V/Hz control.

3) Single induction motor with speed or torque control.

The block diagrams for these 3 control modes are shown in figures 1.2a, 1.2b, 1.2c, and 1.3.

Note 1: For Speed or Torque control, as mentioned above, a tachometer is required. The use of an analog tachometer is not encouraged because the effects of offsets and non-linearities are difficult to compensate for. The use of a Digital Tachometer (incremental encoder or "pulse-tach") requires the purchase and installation of an option board. The use of an Analog Tachometer requires the purchase and installation of a "Special PAL Chip". See sections 9.1 and 9.2 for more information.

Note 2: 6SE12 Simovert-P Chassis Models with Pulsed Resistor Braking contain a very small capacity internal braking resistor. The NEMA 1 Models contain no internal Braking Resistor. Depending on the application, it is usually necessary to purchase and install an external Braking Resistor. See section 8.1 for more information.

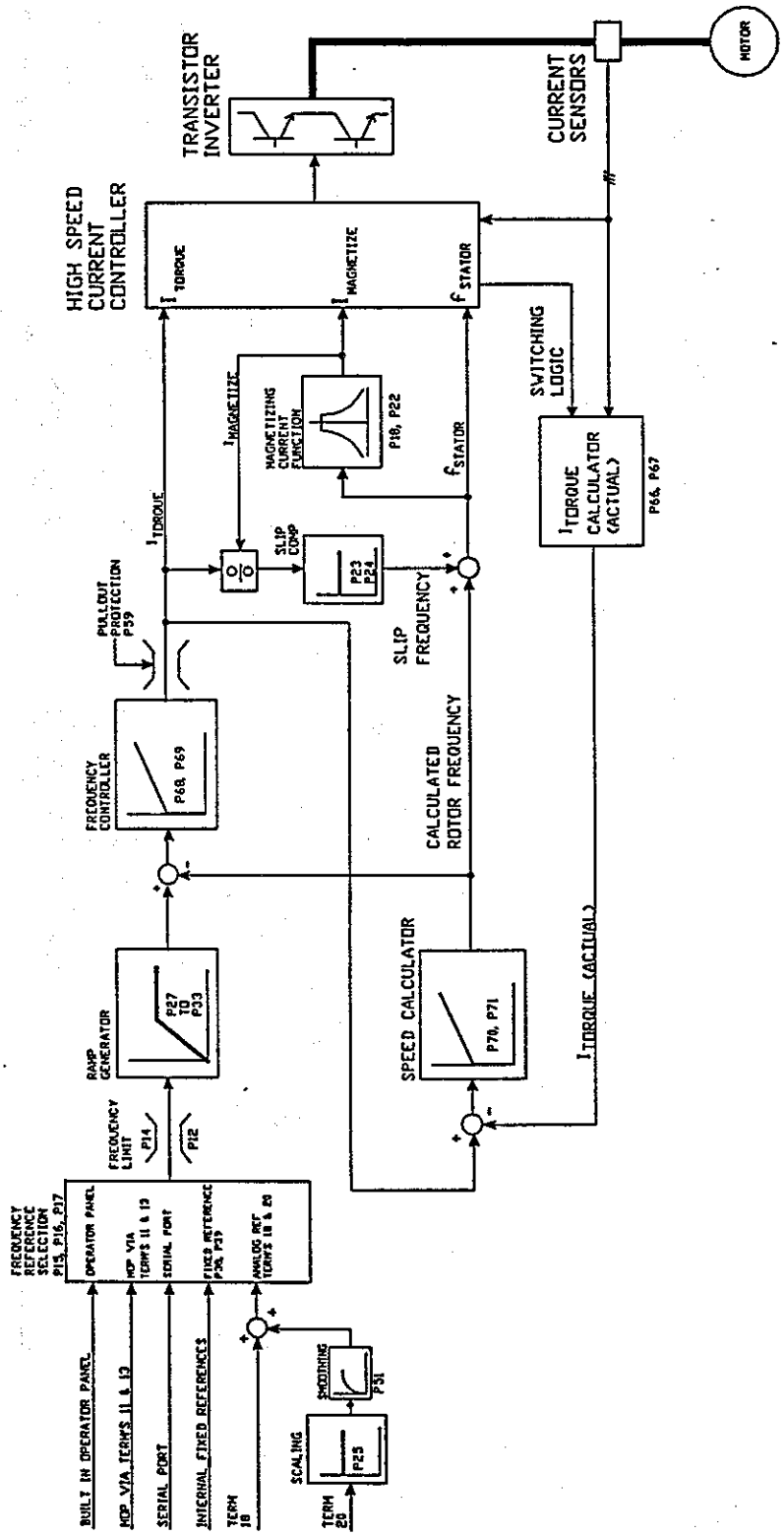


FIGURE 1.2A

Single Motor Drive – Frequency Regulated without Tachometer

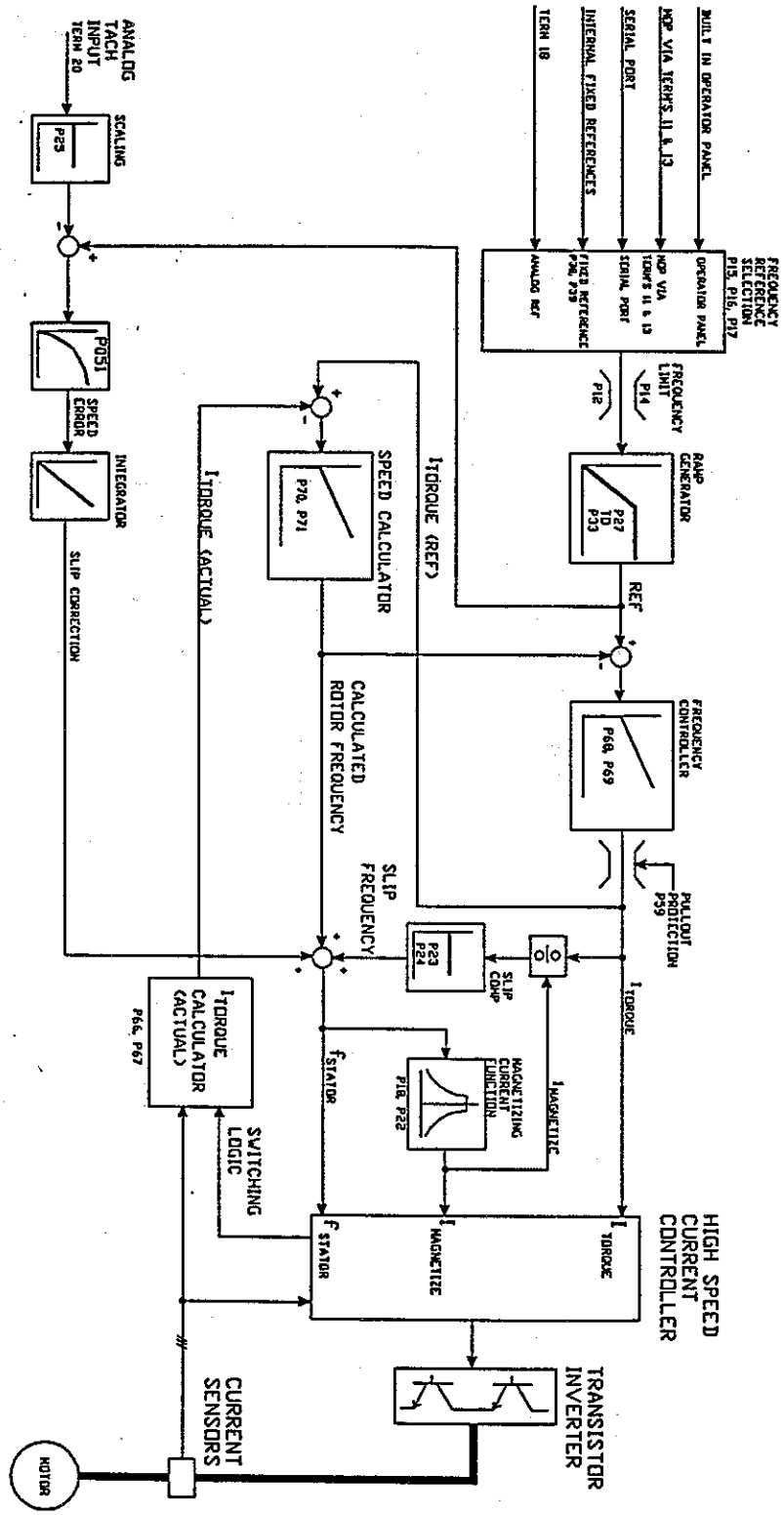


FIGURE 1.2B

Single Motor Drive – Frequency Regulated with Analog Tachometer

(Requires Software Option Chip .. reference section 9.2)

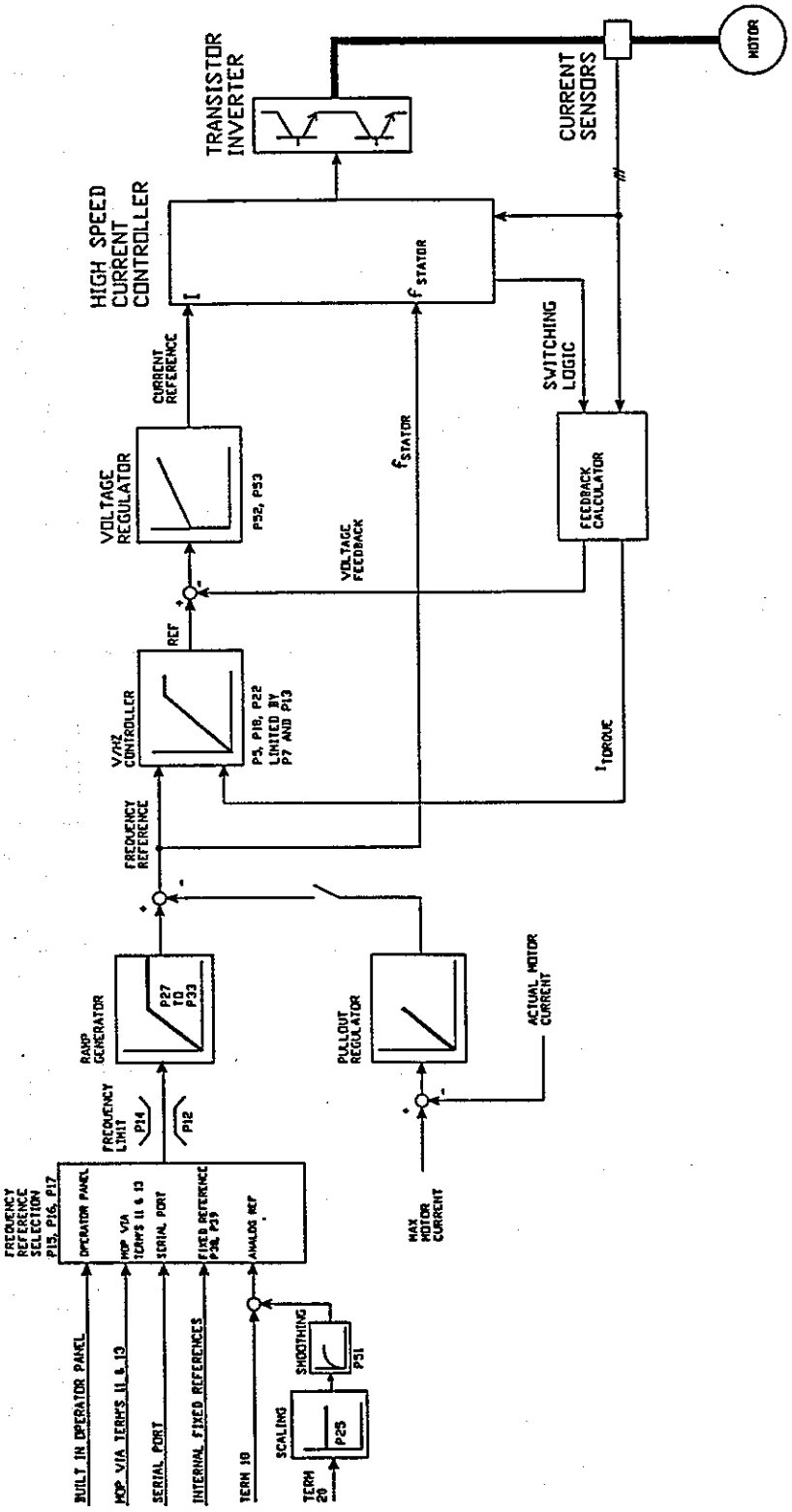


FIGURE 1.2c

Single or Multi Motor Drive – V/Hz Regulation

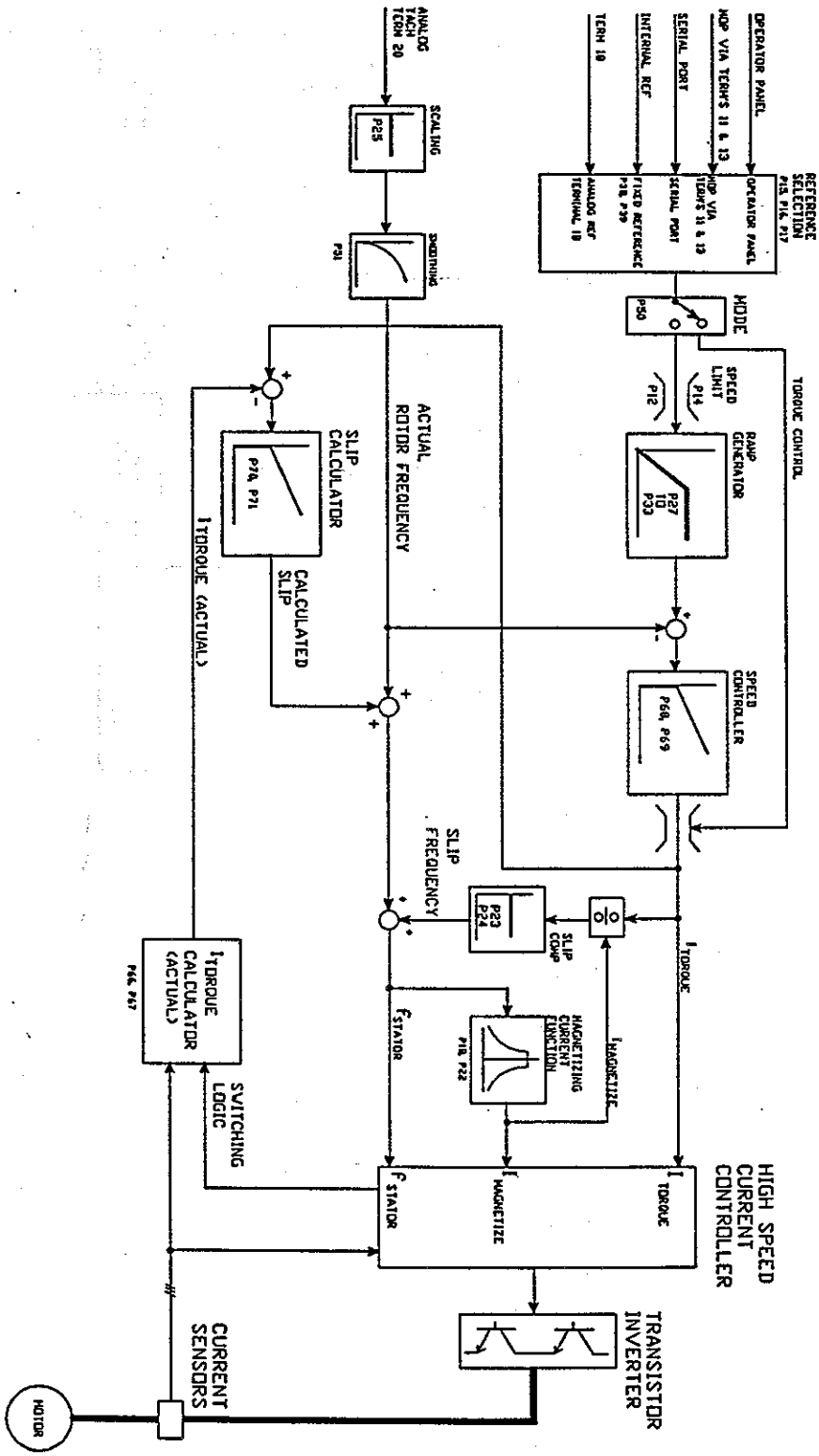


FIGURE 1.3

Single Motor Drive – Speed or Torque Regulated

(Requires Software Option Chip .. reference section 9.2)

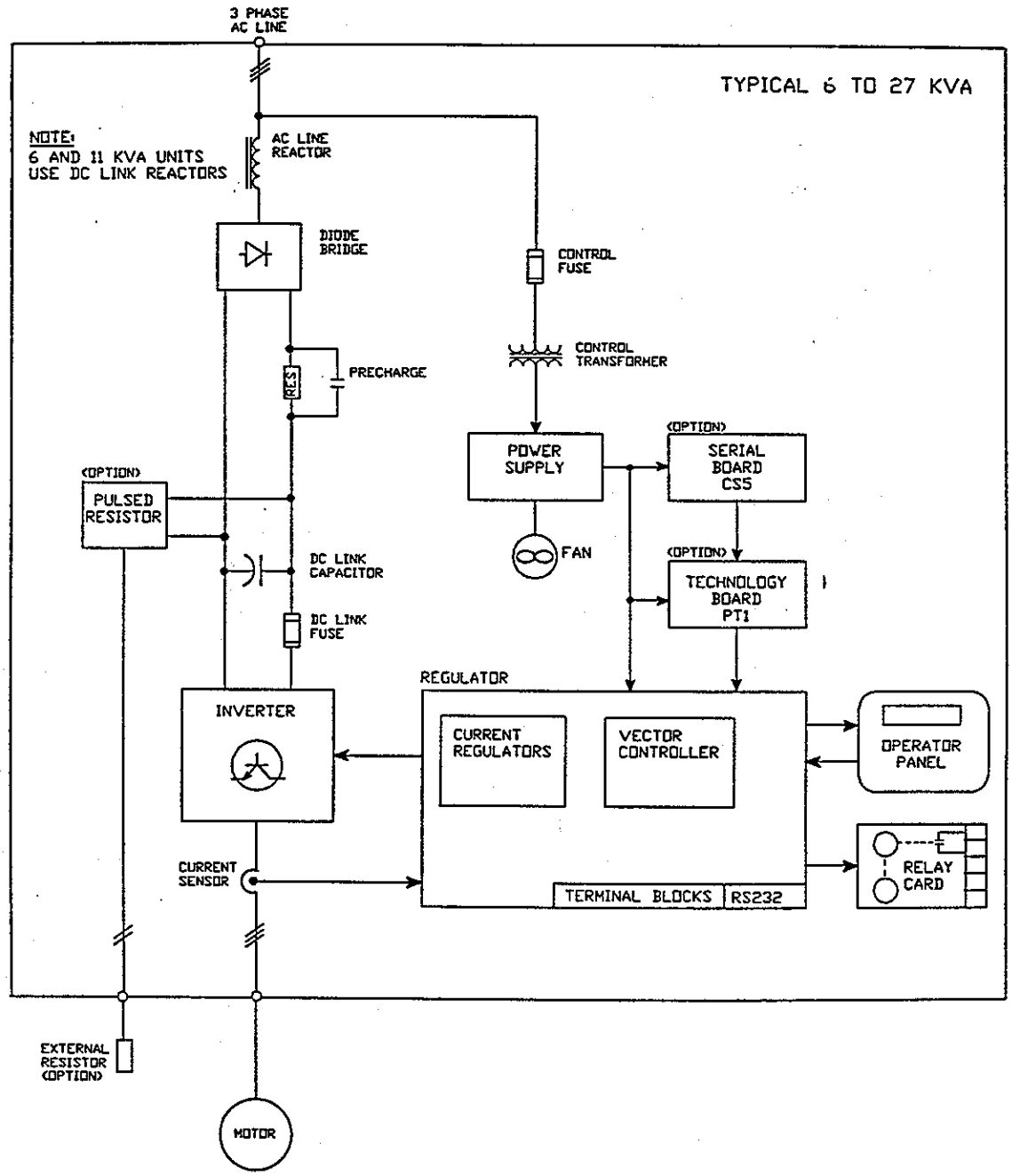


FIGURE 1.4

Inverter Single Line Diagram, 6 to 27 KVA Models

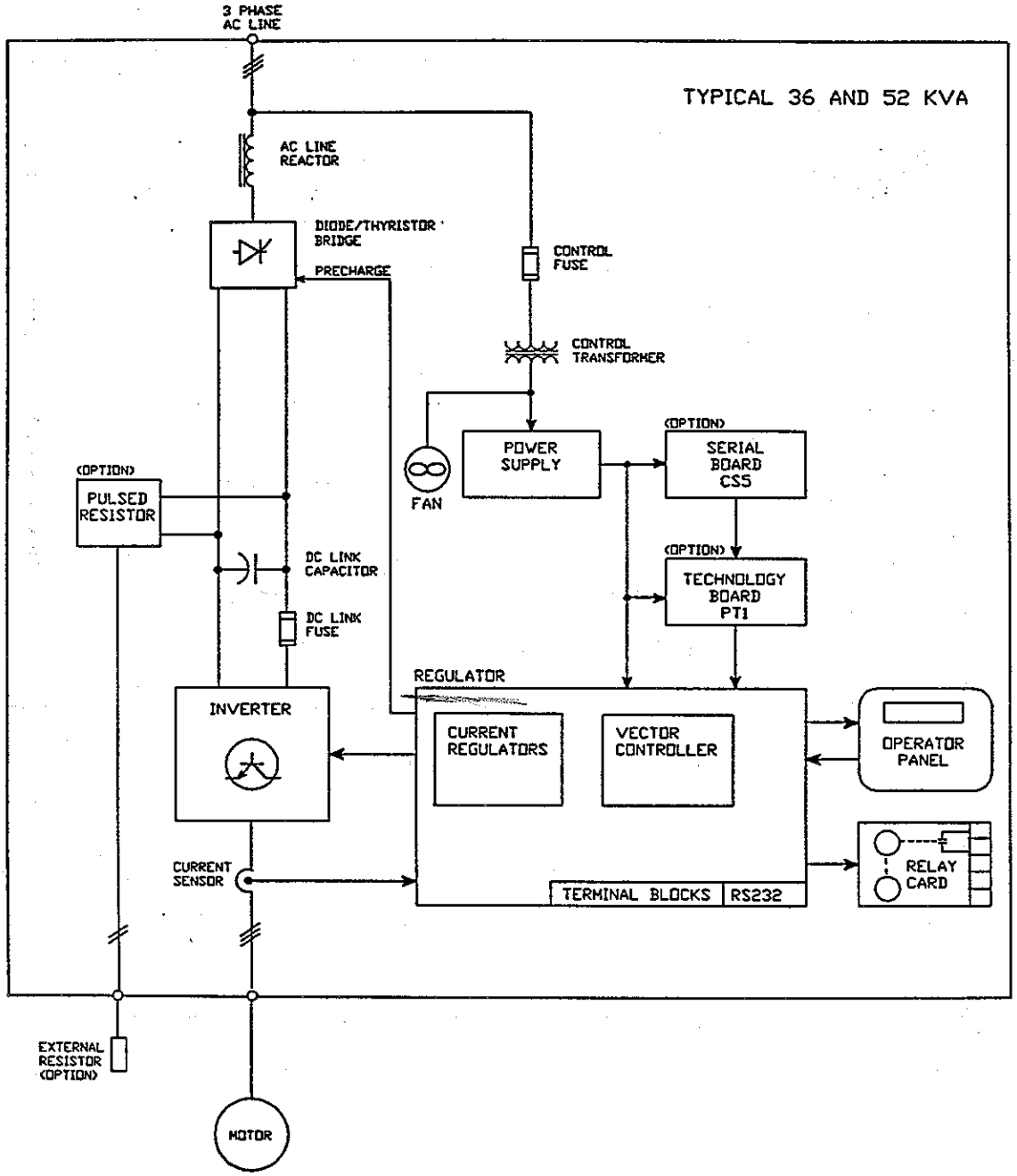


FIGURE 1.5

Inverter Single Line Diagram, 36 to 52 KVA Models

MODELS

6SE12 Simovert-P inverters are available in "Chassis" and NEMA 1 designs. Both designs are available with and without Pulsed Resistor Braking. The user or Applications Engineer must order the Chassis Models with or without Pulsed Resistor Braking as the application requires. The user or Applications Engineer should order the NEMA 1 Models with or without Pulsed Resistor Braking as the application requires. "Add-on" Pulsed Resistor Braking Kits are available to convert Non-Pulsed Resistor NEMA 1 Models to Pulsed Resistor NEMA 1 Models. The following are the standard, "off-the-shelf" models :

Chassis Models Without Pulsed R Braking:

Rated KVA	Part Number	Model Number
6	A1-108-110-503	6SE1206-3YA00
11	A1-108-110-504	6SE1211-3YA00
18	A1-108-110-505	6SE1218-3YA00
27	A1-108-110-506	6SE1227-3YA00
36	A1-108-110-507	6SE1236-3YA00
52	A1-108-110-508	6SE1252-3YA00

NEMA 1 Models Without Pulsed R Braking:

Rated KVA	Part Number	Model Number
6	A1-108-120-503	6SE1206-3YA00-Z
11	A1-108-120-504	6SE1211-3YA00-Z
18	A1-108-120-505	6SE1218-3YA00-Z
27	A1-108-120-506	6SE1227-3YA00-Z
36	A1-108-120-507	6SE1236-3YA00-Z
52	A1-108-120-508	6SE1252-3YA00-Z

Chassis Models With Pulsed R Braking:

Rated KVA	Part Number	Model Number
6	A1-108-150-503	6SE1206-3YB00
11	A1-108-150-504	6SE1211-3YB00
18	A1-108-150-505	6SE1218-3YB00
27	A1-108-150-506	6SE1227-3YB00
36	A1-108-150-507	6SE1236-3YB00
52	A1-108-150-508	6SE1252-3YB00

NEMA 1 Models With Pulsed R Braking:

Rated KVA	Part Number	Model Number
6	A1-108-160-503	6SE1206-3YB00-Z
11	A1-108-160-504	6SE1211-3YB00-Z
18	A1-108-160-505	6SE1218-3YB00-Z
27	A1-108-160-506	6SE1227-3YB00-Z
36	A1-108-160-507	6SE1236-3YB00-Z
52	A1-108-160-508	6SE1252-3YB00-Z

The following "kits" are available for NEMA 1 Models of the 6SE12 Simovert-P:

For 6 to 11 KVA : A1-108-161-501 (catalog # PB01L) 26 Amp Pulsed Resistor Braking Kit
For 18 to 51 KVA : A1-108-161-502 (catalog # PB02L) 67 Amp Pulsed Resistor Braking Kit

See important comments about Pulsed Resistor Braking Kits on next page.

The Pulsed Resistor Braking Kits described on the previous page are for use with the NEMA 1 6SE12 Models only. All NEMA 1 Model 6SE12 Simovert-P's contain no internal Braking Resistors. The Pulsed Resistor Braking Kits contain no Braking Resistors.

The Chassis Model 6SE12 Simovert-P's with Pulsed Resistor Braking contain an Internal Resistor that provides a very small amount of braking capability. This Internal Braking Resistor will generate significant heat when the inverter is Braking. This should be taken into account when designing a system or cabinet layout.

With all NEMA 1 Model 6SE12's with Pulsed Resistor Braking, and with most Chassis Model 6SE12's with Pulsed Resistor Braking, an external Braking Resistor must be purchased and installed. Refer to section 8.1 for more information.

380/400/415 VAC Models of the 6SE12/6SE13 Simovert-P are available up to 160 KVA. They will not be described in this Instruction Manual. 460/500 VAC 6SE13 Simovert-P's (almost identical to 6SE12) are available up to 200 KVA. They will not be described in this Instruction Manual. "Engineered Drives" in various enclosures and many "custom" options are available. Contact a Siemens Sales Office or Siemens Energy & Automation Inc, Drive Products Group, at 404-740-3000 for more information.

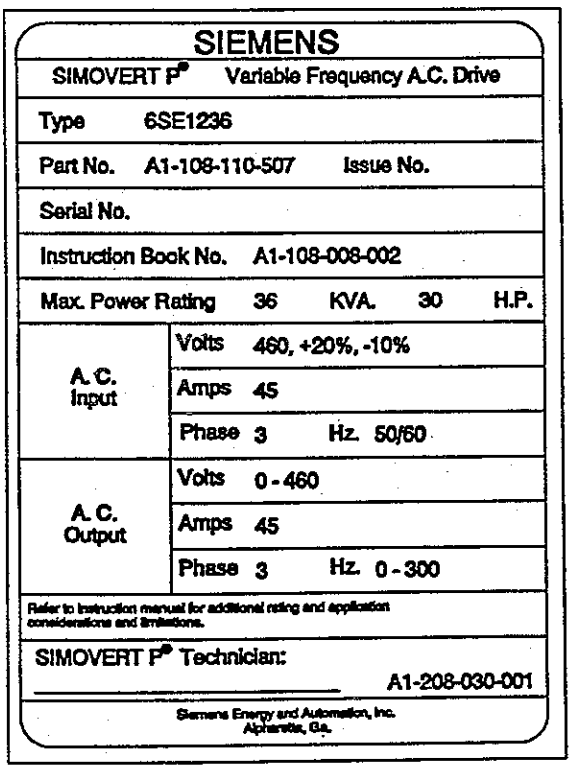
Inverter Ratings

Inverter KVA ratings, inverter rated current (allows 50% X 1 minute overload), maximum continuous inverter current (allows no overload), and selectable motor horsepower range are indicated in the following chart :

Inverter KVA Rating	Inverter Current Rating for 50% 1 min OL	Inverter Current Rating for no overload	Selectable Motor Horsepower Range
6 KVA	8.5 A	9.4 A	2 → 7½ HP
11 KVA	14 A	15.4 A	5 → 15 HP
18 KVA	23 A	25.5 A	7½ → 20 HP
27 KVA	34 A	37.4 A	10 → 30 HP
36 KVA	45 A	49.5 A	15 → 40 HP
52 KVA	65 A	71.5 A	20 → 60 HP

See parameter 19 description in section 6 for explanation of "50 % overload" and "no overload" ratings.

The following is a typical 6SE12 Simovert-P nameplate which is located on the inside of the unit's door :



INVERTER RATINGS:

INVERTER RATED KVA	RATED CURRENT	1.5 x RATED CURRENT
6 KVA	8.5 A	12.8 A
11 KVA	14 A	21 A
18 KVA	23 A	34.5 A
27 KVA	34 A	51 A
36 KVA	45 A	67.5 A
52 KVA	65 A	97.5 A

The inverter may operate continuously at 110% of its nameplate current rating, however, if operated in this way (at 110%), the inverter will have no overload capability. i.e. the inverter will not be able to deliver 111% or more current for even a short time without faulting on "inverter overload". See parameter 19 description in chapter 6 for a more detailed explanation.

Definitions:

Rated KVA / Rated Current :

Output values which the inverter can deliver continuously and independently of the selected operating mode.

1.5 x Rated Current :

Overload values of output current which the inverter can deliver on a duty cycle basis. The maximum overload cycle time permitted is 10% based on a ten minute cycle. This allows 1.5 times rated current for 1 minute followed by 100% current or less for 9 minutes.

OTHER MODELS: 380/400/415 VAC Models of the 6SE12/6SE13 Simovert-P are available up to 160 KVA. They will not be described in this Instruction Manual. 460/500 VAC 6SE13 Simovert-P's (almost identical to 6SE12) are available up to 200 KVA. They will not be described in this Instruction Manual. "Engineered Drives" in various enclosures and many "custom" options are available. Contact a Siemens Sales Office for more information, or see section 7.7 for Siemens Technical Assistance phone numbers.

TECHNICAL DATA:

Incoming AC Line Voltage	3 Phase, 460 V + 20% - 10%
Line Frequency	49 to 61 Hz
Line Power Factor	typically > 0.98, depends on load.

Output voltage	3 Phase, 0 to Incoming Line Voltage
Overload Current	1.5 times rated current for 60 seconds
Maximum Continuous Output	1.1 times rated current
Output frequency	0 to 300 Hz
Load Power Factor	< 0.92 Inductive
Typical Efficiency	97% (typical, at full load)

Ambient Temperature	0 to 50°C open chassis 0 to 40°C NEMA 1
Storage Temperature	-20°C to +55°C
Enclosure	NEMA 1 and Chassis standard (NEMA 12 available)
Relative Humidity	95% Non-condensing
Maximum Altitude	3300 feet (1000 meters) without derating

Control Method	Sinusoidal PWM Current Control
Regulation Method	"Vector Control" or "V/Hz Control" standard. "Speed Control" & "Torque Control" optional.
Frequency Stability	Analog Setpoint > ± 1% of fmax "MOP" function > ± 0.1% of 300 Hz
Frequency Setting Resolution	.01 Hz ("MOP" function, or serial link)

Note about Speed Regulation : Because of the many choices in control method (vector, V/Hz, speed, etc.), and the great variation in motor characteristics, it is not practical to provide a "Standard Specification" for "Speed Regulation" However, the following general statement applies : With "good tuning" and "optimized slip compensation", the standard 6SE12 Simovert-P, <u>without</u> a tachometer can provide "very good" speed regulation, typically beter than 1%. In many cases speed regulation <u>without</u> a tachometer will be "as good as" an installation with a tachometer.

TECHNICAL DATA: (continued)

Motor Type	Single Induction Motor Multi-Induction Motors
Automatic Restart	Auto-restart after power failure is a selectable feature. "Flying Restart" into a spinning motor requires the purchase and installation of an Option PAL Chip.
Control Source (start/stop)	Digital Operator Panel Terminal Block Inputs Serial Port Option Modules
Frequency Reference Source	Operator Panel - "MOP" function Terminal Block - "MOP" function Terminal Block - Fixed References Analog Inputs (2) - Voltage or Current Serial Port, standard RS232 on Control Module Option Module (communication or tech boards)
Motor Control	Frequency (slip compensated) Speed (option, see comments, sect 9.2) Torque (option, see comments, sect 9.2) Digital Tach (option, see section 9.1)

Analog Outputs	Two Selectable (±10 VDC @ 10 mA). See section 6, P040 & P041 for other scaling.
Relay Outputs	Four Selectable Relays each with one N.O. contact rated 10A @ 125 VAC
Analog Inputs	Two Selectable. 0 → ±10 V, 2 → ±10 V, 0 → 20 mA, 4 → 20 mA. Others possible.
Binary Control Inputs	Ten (24 VDC Control). +4 to +33 V = logic hi 0 to +1.0 V = logic low
Display and Indicating LED's	Operator Panel w/ 2 Line x 16 Character LCD Display. 5 Indicating LED's. See figure 5.1.

Protection / Indication and Fault Display	33 Warnings and/or Faults are evaluated and indicated on Operator Panel by an LED and a text display. Also, programmable fault output – see parameter P042 in chapter 6.
External Fault Input	1 Selectable Input (24 VDC) (an open contact indicates a fault)
External Fault Reset	One Input (24 VDC)
Fault Memory & Diagnostics	Non-volatile memory of last 5 faults. Limited warning memory. See chapter 6 P912, 913, 914.

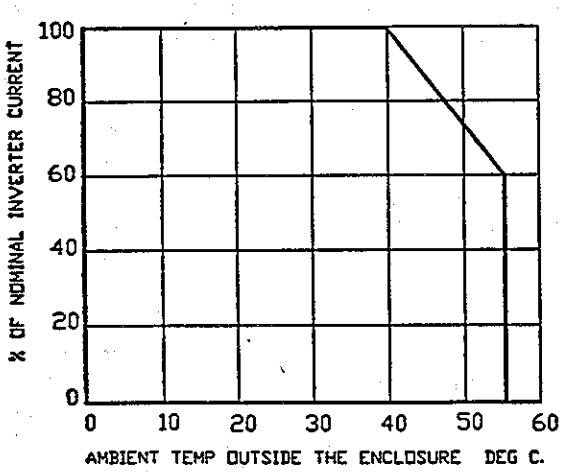
TECHNICAL DATA: (continued)

Software Options (must be purchased)	1) Speed / Torque Control with Tach. See important comments, section 9.2 2) Restart into a Spinning Motor.
Option Modules (must be purchased) see section 9 for more information on Option Modules	1) CS51 Serial Interface Module for Serial Communications to a Host System. 2) PT1 Technology Module for Custom Applications. 3) Z2006 Technology Module for pre-engineered applications and Serial Communications.
Electrical Braking	Choose Models with Pulsed Resistor Braking

NEMA ENCLOSURE DERATING CALCULATIONS :

For the NEMA 1 design or when the Chassis unit is enclosed in a NEMA 1 enclosure, the ambient temperature outside the enclosure must not exceed 40°C for the standard product ratings to apply. If ambient temperatures higher than 40°C are possible, the following derating must be used:

AMBIENT DERATING

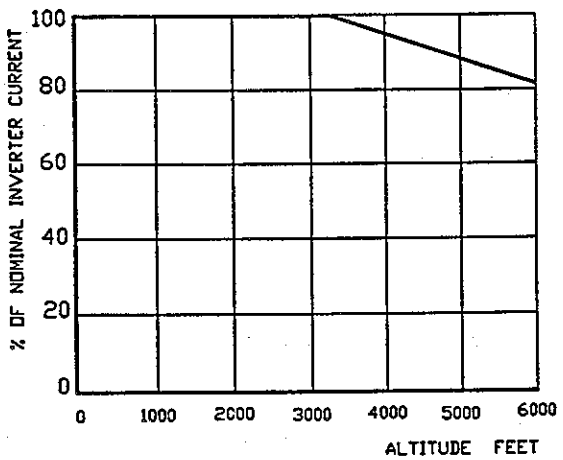


When a chassis unit is installed in a NEMA 1 enclosure, forced ventilation is usually required to limit the temperature inside the enclosure to 50°C when the outside temperature is 40°C. The following are typical CFM ratings for door mounted fans for various 6SE12 Simovert-P models:

6 to 27 KVA ..... 165 CFM
36 and 52 KVA .... 310 CFM

This, of course, depends on the enclosure. For any particular design, enclosure vendors will usually offer cooling/ventilation advise or recommendations.

ALTITUDE DERATING



Chassis models of the 6SE12 Simovert-P are rated for full output in a 50°C environment. However, Chassis models are not intended for installation "out in the open". Therefore, most users will use an enclosure and the derating curves shown above apply.

If an analysis based on a Chassis model 6SE12 installed "out in the open" is required; then a qualified person can make a common sense extrapolation of the de-rating charts shown above. Note, however, that the KVA rating is: 0 KVA above 55°C.

3.1 Receiving

Thoroughly inspect the equipment before accepting shipment from the transportation company. Compare each item received against the packing slip.

Check the condition of the SIMOVERT-P drive controller chassis and heatsink for damage, dents, and for loose or broken parts. Open the door on the front and inspect the circuit boards for loose or missing components or disconnected wires. Check all connectors for tightness.

Any shortage or damage should be reported promptly to the carrier. If any concealed loss or damage is discovered, file a claim promptly with the carrier, requesting him to make an inspection. **FAILURE TO FILE A CLAIM PROMPTLY MAY PREVENT YOU FROM COLLECTING FOR LOSS OR DAMAGE.** If required, assistance may be requested from the local Siemens sales office.

3.2 Handling

⚠ WARNING

Heavy equipment. Improper lifting can cause loss of life, or serious personal injury.

Lift only with adequate equipment and trained personnel. Drive units with or without cabinets are top heavy and will tip easily until securely anchored in place.

3.3 Storage

If the 6SE12 Simovert-P drive controller is not to be installed immediately it should be stored in a clean, dry location at ambient temperatures from -20°C, (-4°F), to +55°C, (+131°F). The surrounding air must be free of corrosive fumes or electrically conductive contaminants. Care must be taken to prevent condensation from forming within the equipment enclosure during storage. A space heater may need to be installed if condensation or excessive moisture is expected.

Motors, transformers and other equipment supplied as part of the order may also have storage limitations. Refer to the manuals supplied with this equipment for specific recommendations.

3.4 Drive Controller Location

SIMOVERT-P drive controllers supplied as open chassis units will normally require an enclosure for installation that meets the applicable safety codes.

The type of enclosure, (NEMA 1, NEMA 4, NEMA 12, etc.), will depend on the ambient conditions at the installation site. Refer to the outline drawing for detailed information on dimensions, weight, heat loss data, and other information important for installation.

The purchaser of Open Chassis Models is responsible for assuring proper installation that meets the requirements listed below as well as any applicable safety codes.

Simovert-P drive controllers supplied in either wall mounted or free standing enclosures are generally suitable for installation in most factory areas. In choosing a location for the controller, be sure to consider the need for adequate clearance to allow circulation of cooling air. Ample room must also be provided to permit the door to swing open for maintenance and service. Consult the outline drawing supplied with the sales order drawings for further details.

Unless designed for special requirements specified in the original sales order, the drive controller should be installed where the following conditions exist:

1) Ambient temperature is between 0°C and +50°C (Chassis Models) or 0°C and +40°C (enclosed).

2) Altitude above sea level does not exceed 3300 feet (1000 meters).

3) Relative humidity is less than 95% non-condensing.

4) Atmosphere is reasonably free of dirt, dust, combustible vapors, chemical fumes, oil vapor, and electrically conductive or corrosive materials.

5) Mounting surfaces are level and sufficiently rigid to support the weight of the equipment.

   DO NOT MOUNT ON SURFACES THAT ARE SUBJECT TO SHOCK OR VIBRATION.

6) The power line feeding the drive has good continuity of service and stays within the allowable voltage tolerance.

7) The area is free of electromagnetic interference or noise, caused for example, by:

   a. Strong radio frequency signals.

   b. Stray high voltage or high frequency signals, such as those generated by arc welders, or switching unsuppressed inductive loads.

3.5 Mounting

SIMOVERT-P 6SE12 inverters must be mounted vertically on a suitable surface in accordance with the outline drawings (refer to appendix A for details).

3.6 Motor Cable Length

With long motor cables, or when multiple motor cables are parallel connected, it <u>may</u> be necessary to purchase and install output inductors. Motor cable length is usually a non-issue; but, is important in some applications. Read section 8.2 if there is any question or concern about motor cable length.

4.1 Wiring Precautions

⚠ WARNING

This equipment contains hazardous voltages and rotating parts. Loss of life, severe personal injury or property damage can result if instructions contained in this manual are not followed.

The user is responsible for installation of the motor, controller, transformer, and other devices in accordance with the Nation Electrical Code and other applicable local codes.

⚠ WARNING

Hazardous voltages may be present on external surfaces of ungrounded controllers. This can result in loss of life, severe personal injury, or substantial property damage.

The drive controller and enclosure must be grounded for personnel safety. The transformer, motor, and operator panel enclosures must also be connected to earth ground. Consult the Nation Electrical Code and local codes for grounding requirements.

NOTE:

When the drive controller is supplied without a circuit breaker or fused disconnect on the incoming AC line, the user is responsible for installing such a device in order to meet the overcurrent protection requirements of the National Electrical Code. Be sure that the overcurrent protection is capable of interrupting the available fault current from the power system feeding the drive controller.

Consult the rating plate inside the controller to determine the current ratings required for operation. The wiring must then be sized in accordance with the National Electrical Code and other applicable local codes.

Installation will require electrical connections between the motor and drive unit; the transformer (if used) and the drive unit; and the operator devices (if used) and the drive unit. Standard SIMOVERT-P controllers can be wired using the information contained in this Instruction Manual.

When a controller is supplied with additional options, components, or circuits that are not part of the standard SIMOVERT-P unit, a "custom" schematic will be supplied as part of the sales order documentation. Refer to this drawing for details on how to wire the controller and associated equipment.

If a transformer is supplied as part of the equipment, the user is normally responsible for providing the primary short-circuit protection in accordance with the National Electrical Code and applicable local codes.

⚠ CAUTION

Drilling or punching can create loose metal chips. This can result in shorts or grounds that can damage the equipment.

If it is necessary to drill or punch holes in the equipment enclosures for conduit entry, be sure that metal chips do not enter the circuits.

Circuits shown on the drawings that require shielded cable are sensitive to pickup from other electrical circuits. Erratic or improper operation of the equipment is likely if the following precautions are not observed:

1. Where shielded cable is required, use 2- or 3- conductor TWISTED AND SHIELDED cable with the shield connected as shown in the drawings.

2. Shielded cables outside of the enclosure should be run in separate steel conduit, and should not be mixed in with other circuits that are not shielded.

3. Control circuits, such as the 24 volt dc "START" and "STOP" functions, should be run in separate steel conduit and should not be mixed in with other power or control wiring.

4. Meggering circuits connected to the drive can cause damage to electronic components. Do nor megger or hi-pot this equipment. Use a battery operated Volt-Ohm-Meter to check for shorts, opens, or miswiring.

5. Do not connect any external circuits to the drive or its associated equipment other than those on the diagrams supplied.

6. Connection of unsuppressed inductive devices to the drive power feed or control circuits can cause misoperation and possible damage to the equipment.

7. Do not connect power factor correction capacitors with this equipment. This could cause high voltages that can damage the equipment.

8. An output inductor (reactor) may be required. See section 8.2

4.2 Basic Connection Diagrams

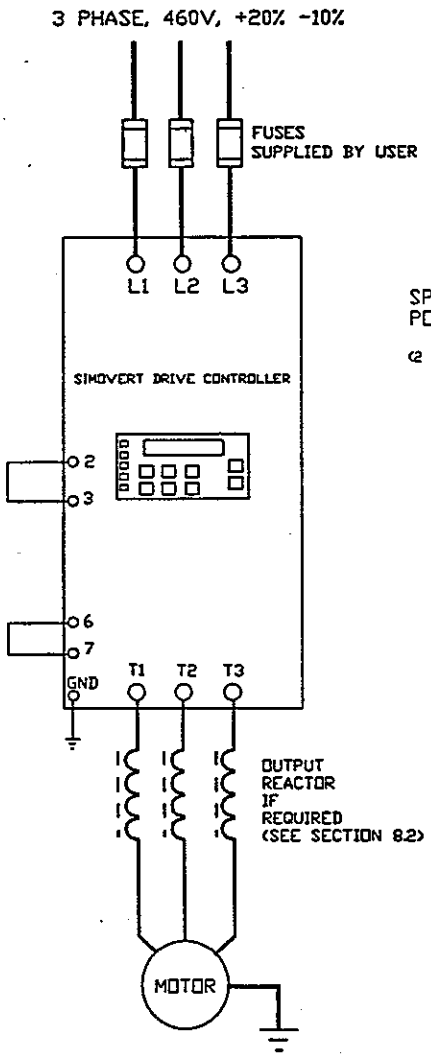


Figure 4.1

Basic Connections
Operation with Parameter 15 = "Local"
(i.e. LCD Display / Operator Panel)

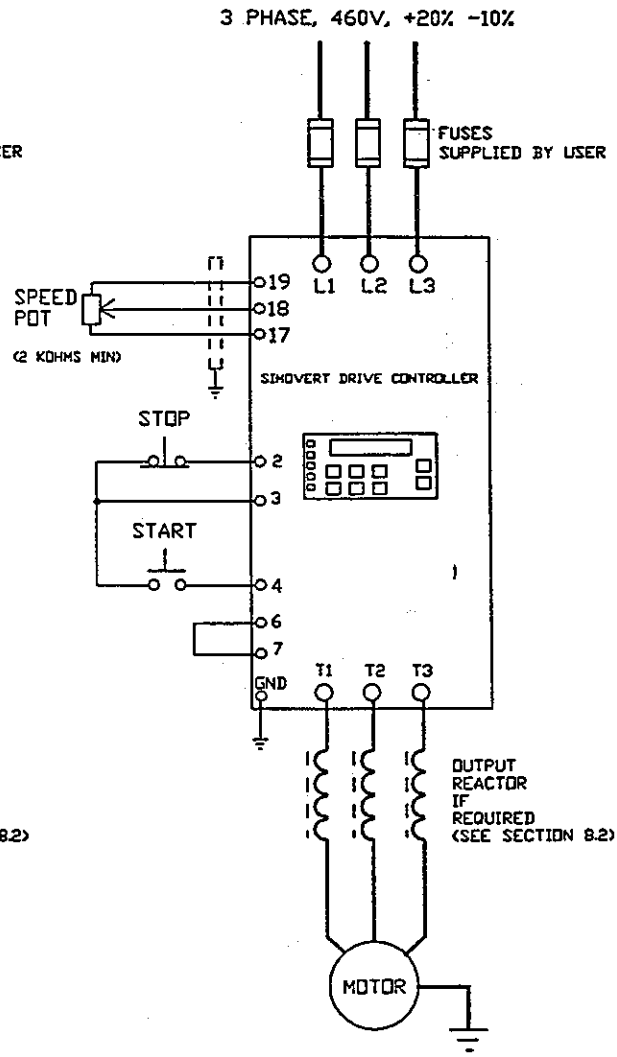


Figure 4.2

Basic Connections
Operation with Push-buttons,
Frequency Reference via Analog Pot

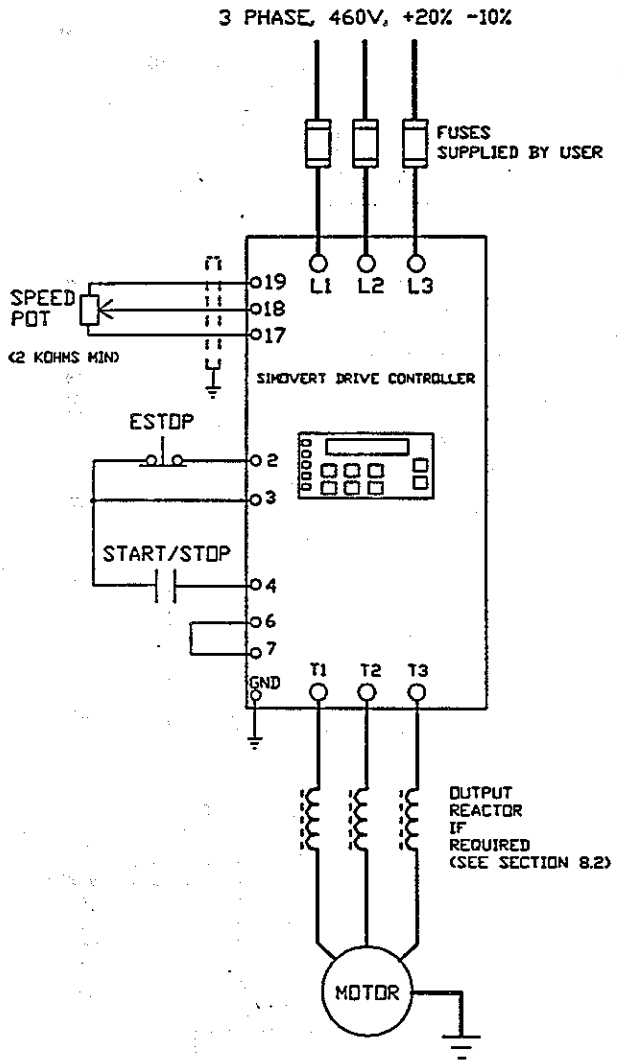


FIGURE 4.3

Basic Connections

Operation with Maintained Contact

Frequency Reference via Analog Pot

With Emergency Stop

4.3 Power Connections

POWER CONNECTIONS

CONNECTION	INVERTER TERMINAL	REMARKS
AC LINE L1 AC LINE L2 AC LINE L3	L1 L2 L3	AC LINE, 3 PHASE 460 V +20%, -10% 49 to 61 Hz PHASE SEQUENCE L1,L2,L3
EARTH GROUND	GND	CONNECTION TO A GOOD EARTH GROUND GRID
MOTOR T1 MOTOR T2 MOTOR T3	T1 T2 T3	INVERTER OUTPUT, 3 PHASE 0 to LINE VOLTAGE 0 to 300 Hz

AC Line Connections

The incoming AC line connecting terminals L1, L2 and L3 are always located in the lower part of the unit immediately behind the door on the left-hand side.

A three-phase AC source with a rated voltage between 460 and 500 V, 50/60 Hz must be connected to the line terminals.

Installation of Incoming AC Line Fuses is recommended – see section 4.4 . Failure to install overcurrent protection on the Incoming AC Lines can result in damage to the plant power distribution system in the event of a 6SE12 Simovert-P failure.

The 6SE12 inverter must be connected to a good earth ground grid using the ground terminal provided on the power terminal strip.

Connecting the incoming AC power cables to the inverter output terminals will cause damage to the inverter.

Motor Connection

The motor should be connected to the terminals located on the right-hand side of the power strip labeled T1, T2, and T3. The motor frame must be solidly connected to an earth ground (usually in the vicinity of the motor).

In some installations, an output inductor, located between the inverter and motor may be required. Refer to section 8.2 for more information.

IMPORTANT : AC line switches, contactors, or circuit breakers located between the motor and inverter should only be operated when the inverter output pulses are inhibited. There are some exceptions to this (e.g. multi – motors may have individual overloads). However, typical industrial contactors will be damaged if they attempt to interrupt the current controlled PWM output of the 6SE12 Simovert-P; especially at low output frequencies.

4.4 AC Line Fuses (or Breaker)

For maximum protection and reliability it is recommended that "high speed current limiting fuses," also known as "semiconductor fuses" be installed in the incoming AC lines (L1, L2, L3) to the 6SE12 Simovert-P. GOULD SHAWMUT TYPE A50P or Bussmann type FWH are typical examples. The table below shows recommended current ratings.

An incoming AC line circuit breaker may also be used. A properly sized and installed circuit breaker will provide adequate safety protection to the wiring and power system.

INVERTER KVA	LINE FUSE 500 VOLT	BREAKER RATING 480 VOLT RATED
6 KVA	35 AMP	15 AMP
11 KVA	35 AMP	25 AMP
18 KVA	70 AMP	60 AMP
27 KVA	70 AMP	60 AMP
36 KVA	150 AMP	100 AMP
52 KVA	150 AMP	100 AMP

Generally, circuit breakers will provide less protection against rectifier failure than high speed fuses will. (Rectifier = 6SE12 Simovert-P incoming AC line diode modules and/or SCR modules)

The user must make the decision to use fuses (which provide much better protection to the 6SE12 Simovert-P), or to use circuit breakers (which are convenient and do not require stocking and replacing fuses). The advantages and tradeoffs are obvious.

In all cases, the user must assure that the incoming AC line overcurrent protection is appropriate for the voltage and available short circuit current of the power system.

See section 8.3 for Siemens part #'s for fuses & fuseholders.

4.5 Signal Connections

Signal connections are made directly to the 6SE12 Simovert-P microprocessor control board "Control Module" shown in figure 4.4 (on page 4-11). For this reason, cables must be kept as short as possible and good wiring and engineering practices must be used to reduce electromagnetic noise (EMC) problems. In some cases, signal isolators and/or interposing relays will be necessary between remote pilot devices and the 6SE12 Control Module. This is a requirement when the command and control wiring is "long" or is routed through an "electromagnetically noisy" area.

The chassis and Control Module "signal common" are at ground potential. The common side of external signals connecting to the Control Module must therefore be at ground potential.

If external signals to the Control Module have common mode voltages with respect to the Control Module ground, the use of isolation amplifiers or signal conditioners is recommended.

As shown on the Control Module diagram (figure 4.4), DIP switch "SW6" determines if terminal 1 is connected directly to "microprocessor board signal common" or if terminal 1 is connected to "microprocessor board signal common" thru a "noise suppressing inductor". The inductor is a 56 μH surface mount component on the board. SW6 is "open" as shipped from the factory. This is usually the correct condition because it is usually not good to connect field wiring directly to a microprocessor board signal common. However, in some rare cases, it is appropriate to close SW6 - an experienced Systems Engineer or EMC (electromagnetic compatibility) expert will have to make that decision on a case by case basis.

(continued on next page)

4.5 Signal Connections (continued)

All control signals are connected to the inverter on the 30 point terminal strip located on the Control Module behind the inverter door. See figure 4.4 for layout of the Control Module.

The 30 point terminal block has the following functions assigned:

Terminals 1 to 15 : 24 volt DC binary inputs

Terminals 16 to 21 : analog inputs

Terminals 22 & 23 : analog outputs

Terminals 24 & 25 : for a motor PTC thermistor or thermostat if used

Terminals 26 to 30 are open collector 24 volt DC outputs

All analog control cables should be shielded and routed separately from power cables. They should be brought into the inverter from the bottom through the aluminium wire channel located on the right-hand side of the unit behind the door.

The shielding should be connected at the upper end of the aluminum wire channel at the contact tabs provided.

Important:

Before connecting wires to the Control Module, first disconnect the 6SE12 Simovert-P from the AC line and allow "a few minutes" for the DC Link capacitors to discharge.

Terminals 1 thru 30 (also labeled "X11 thru X14") on the Control Module are removable. It is convenient to unplug the terminals from the Control Module when connecting field wiring.

If the operator panel is mounted external to the 6SE12 SIMOVERT-P, the maximum ribbon cable length from the operator panel to the Control Module is 5 feet (1.5 meters). It is important to keep the ribbon cable as short as possible. Read section 8.3 for more information and for Seimens part #'s for ribbon cables.

4.6 Control Module Wiring

4.6.1 Binary Inputs

The binary inputs (terminals 2, 4, 5, 7, 9, 10, 11, 13, 14, & 15) can be activated either by connecting them to "+24V" (terminals 3, 6, 8, & 12) or by applying an external voltage of +24V DC. If an external 24 volt DC supply is used the common of that supply should be connected to terminal 1 of the Control Module.

Start/Stop (Terminals 2 & 4)

The inverter can be started and stopped using the Operator Panel or by connections to Control Module terminals 2 & 4 (X11).

The determination of the source of the "start - stop" commands is made using parameter P015 (see chapter 6). P015 is also used to determine if control from the terminal blocks is from maintained or momentary contacts (i.e. push-buttons, etc.).

When **MAINTAINED** contact control is selected (by P015), terminal 2 becomes an "E-Stop" function and must normally be energized to allow operation. If terminal 2 is de-energized, the inverter transistors are immediately turned off and the motor will coast to a stop. To restart the drive, terminal 2 must be energized again and terminal 4 must be cycled "off" and then "on".

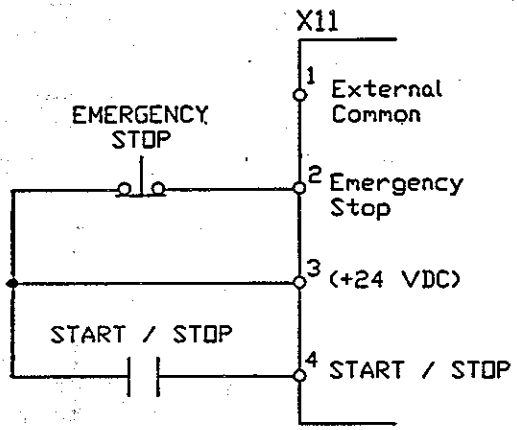
If the drive is powered on with terminal 4 energized an "enable blocked" message will appear on the display and terminal 4 must be cycled "off" and then "on" again before the drive can be started.

An exception to this is when parameter P034 = "Auto Restart After Power Failure - YES". In the case of "Auto Re-start After Power Failure", it is obviously not necessary to cycle terminal 4 off and on.

(see wiring diagram on next page)

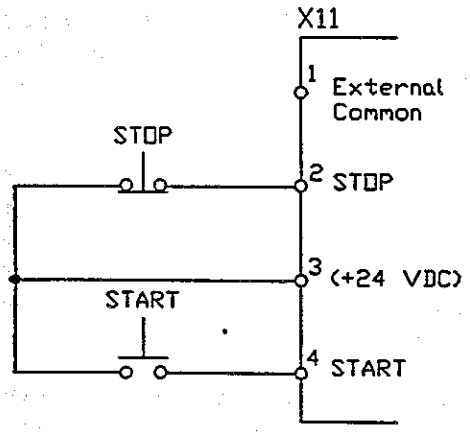
START/STOP INPUTS (continued)

MAINTAINED CONTACTS :



When MOMENTARY contact control is selected (by P015) terminal 2 becomes a "Stop" function and must normally be energized to allow operation. If terminal 2 is de-energized the inverter will stop using the method selected with parameter P026.

MOMENTARY CONTACTS :



DIRECTION & REFERENCE ENABLE
(Terminals 5 and 7)

The direction of rotation of the motor can be controlled by terminal 5. This terminal is only active if control is from the terminal blocks (parameter P015 = choice 2 or 3) and reversing is allowed by the appropriate setting of parameter P036 (see section 6 for parameters).

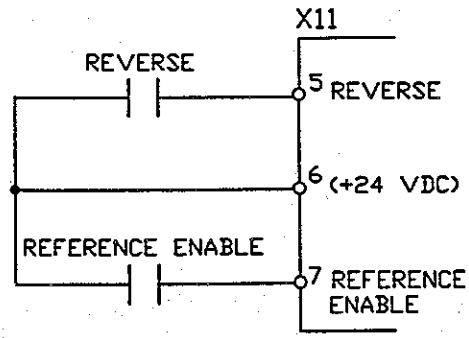
The "normal" reference or "setpoint" is enabled by applying +24 volts to terminal 7. This allows the frequency (or speed or torque) reference to be applied to the ramp when the drive is started. ("normal" reference is defined by parameters P015 & P016)

Terminal 7 has no effect (enable or disable) on preset speeds 1 & 2.

De-energizing terminal 7 causes the motor to slow down following ramp rate #2 (parameter P032) until zero hertz is reached, at which time inverter pulses are blocked.

Terminal 7 is active if control is from the Operator Panel or from the terminal blocks (see parameter P015). Terminal 7 has no effect if control is from "automation" (i.e. parameter P015 = choice 4 or 5).

REVERSE & ENABLE INPUTS :



Ramp Rate 2 or External Fault & Fault Acknowledge
(Terminals 9 & 10)

Terminal 9 can be used to switch to an alternate set of ramp rates or as an input for an external fault. Parameter P037 determines the function of terminal 9.

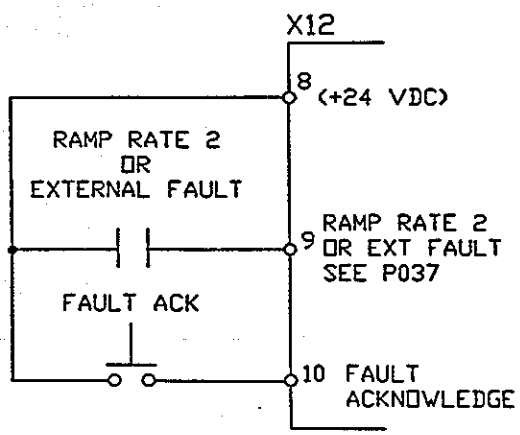
Ramp rate selection is only active when drive control is from the terminal blocks (see parameter P015).

When used as a fault input, terminal 9 must be energized for the "no fault" condition. De-energizing terminal 9 results in immediate inverter pulse blocking and a fault (F017) message.

If parameter P037 = "ext fault", terminal 9 is active for all methods of inverter control (i.e. any choice for parameter P015).

Terminal 10 is used to remotely acknowledge a fault. Fault acknowledgment occurs only for a positive transition of 24 volts at terminal 10. Terminal 10 is only active when control from the terminal blocks is selected (by P015).

Terminal 9 and Fault Acknowledge:



Motor Operated Pot Increase & Decrease
(Terminals 11 and 13)

The internal MOP reference setpoint can be increased or decreased from either the Operator Panel ↑ ↓ keys or terminals 11 and 13 depending on the setting of parameter P017. The resolution or smallest frequency change is 0.01 Hz.

Terminal 11 will increase and terminal 13 will decrease the reference value.

The adjustment rate of the motor operated potentiometer can be varied by parameter P048. P048 applies to adjustment by terminals 11 & 13 only.

If terminals 11 and 13 are simultaneously energized, terminal 11 has precedence.

Internal Fixed References
(Terminals 14 and 15)

Terminals 14 and 15 are used to select internal fixed reference values. When these fixed setpoints are selected they have priority over the "normal" references. ("normal" reference is defined by parameters P015 & P016). The fixed references always use the #2 ramp rate.

Energizing terminal 14 selects Fixed Reference #1 adjustable via P038.

Energizing terminal 15 selects Fixed Reference #2 adjustable via P039.

When either terminal 14 or 15 is energized, the corresponding fixed setpoint is activated, even under reference inhibit (i.e. terminal 7 de-energized).

As soon as terminals 14 and 15 are de-energized the "normal" setpoint (see parameter P016) is applied to the ramp.

Negative fixed setpoints are selected by simultaneously actuating terminal 5 (reverse) and terminal 14 or 15.

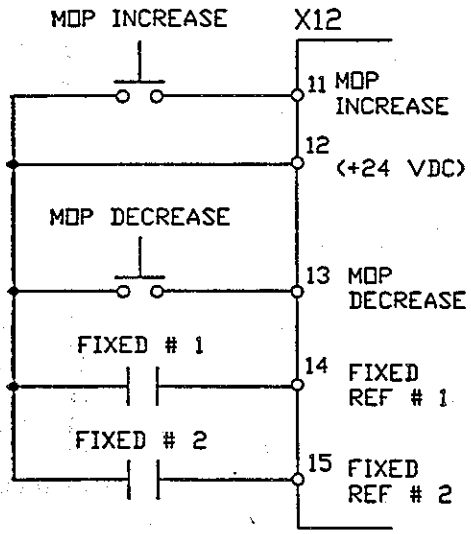
(wiring diagram on next page)

Fixed References (continued)

The setpoints are processed with the following priority:

#1 (highest)	Fixed Setpoint 1
#2	Fixed Setpoint 2
#3 (lowest)	"Normal" Setpoint (terminals 18 & 20 or Operator Panel, or other - see P016)

FIXED REFERENCES AND "MOP" INPUTS :



4.6.2 ANALOG INPUTS
(Terminals 16 thru 21)

Terminals 18 & 20 are analog inputs used for drive setpoint(s) and tachometer feedback. They can be setup as voltage or current inputs using "DIP Hook" switches S4 & S5 as shown on the next page.

Terminals 16 & 19 are precision ±10 V references that can be used as a source for a speed reference potentiometer. Source/sink drive capability is 5 mA max.

Terminals 17 & 21 are the "virtual ground" or "common" points for the analog inputs.

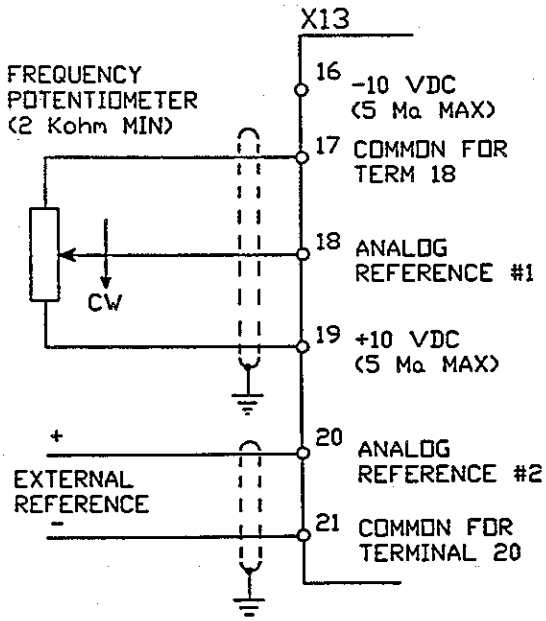
Terminal 18 is scaled for 10 VDC or 20 mA = 100%. Terminal 20 can be setup for F.S. (full scale) input voltages of 10, 20, or 30 volts, or 20 mA = 100%. Parameter P025 scales the input on terminal 20 only, by a factor of 50% to 110%.

If options for speed or torque control are used with an analog tachometer, it must be connected to terminal 20 and an optional PAL chip must be purchased and installed.

Note: use of an analog tach is not recommended – see explanation on page 1-4, Note 1.

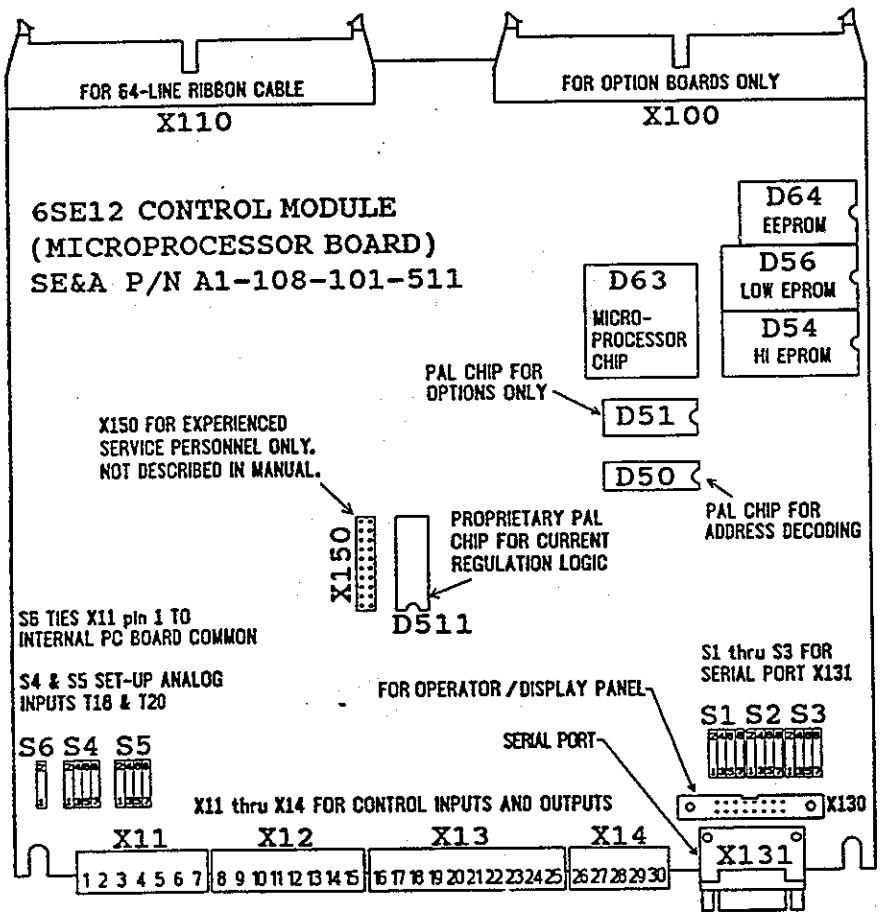
Parameter P016 determines how the frequency reference is generated. Once "voltage or current mode" is selected (by P016), the F.S. (full scale) range must be set with the "DIP HOOK" switches on the Control Module as shown on next page.

ANALOG INPUTS :



(continued on next page)

DIP Hook Switch Settings For Analog Inputs :



6SE12 Control Module – Software Ver 3.0 & newer only!

FIGURE 4.4

Codes for switch configurations:

1 = closed 0 = open x = don't care

\# = open for differential input
\# = closed for single-ended input

Analog inputs T18 and T20 can be "differential" or "single-ended". The far right positions of SW4 & SW5 either "float" or "ground" the "virtual ground" inputs. Differential mode is only possible for 10 V F.S. (full scale) input ranges as indicated by "#" symbol.

FOR TERMINAL 18 = 10 V F.S. :

S4				S5			
x	x	x	x	x	0	1	#

FOR TERMINAL 18 = 20 mA F.S. :

S4				S5			
x	x	x	x	x	1	0	1

FOR TERMINAL 20 = 10 V F.S. :

S4				S5			
0	0	1	#	0	x	x	x

FOR TERMINAL 20 = 20 V F.S. :

S4				S5			
0	0	1	1	1	x	x	x

FOR TERMINAL 20 = 30 V F.S. :

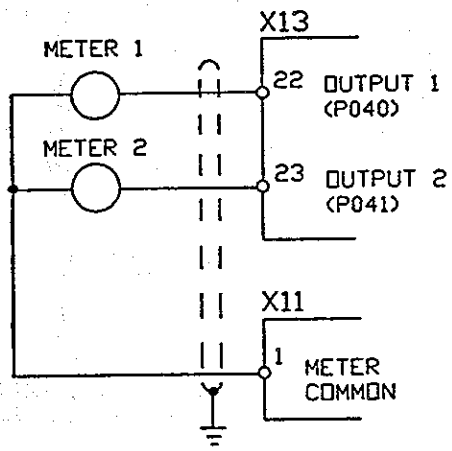
S4				S5			
1	0	1	1	1	x	x	x

FOR TERMINAL 20 = 20 mA F.S. :

S4				S5			
0	1	0	1	0	x	x	x

4.6.3 Analog Outputs (terminals 22 and 23)

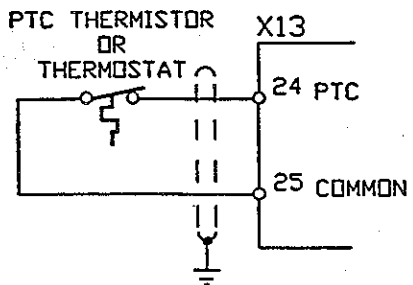
Terminals 22 and 23 provide two analog outputs which can be used for a variety of functions. They are often used to drive indicating meters. Each output is limited to ±10 volts at 10 mA maximum. The meter common connects to terminal 1.



4.6.4 Motor Temperature (Terminals 24 and 25)

Terminals 24 and 25 are inputs for a motor PTC thermistor or thermostat which opens on high temperature for motor overtemperature protection. This function is activated using parameter P054.

If a thermistor is used it should have a resistance ≤ 1 KΩ in the permissible temperature range and a resistance ≥ 2 KΩ in the overtemperature range.



4.6.5 Relay Driver Outputs (Terminals 27 to 30)

Terminals 27 to 30 (X14) provide 4 selectable relay driver outputs. Each open collector output is rated at 24 VDC at 50 mA maximum. Terminal 26 provides a source of 24 VDC for these outputs.

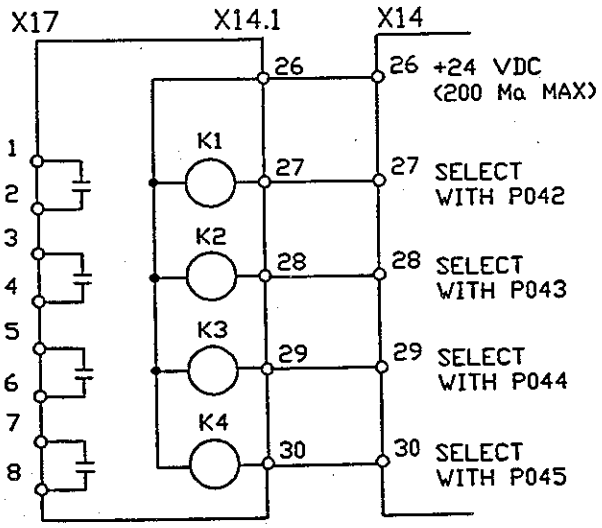
It is intended that binary outputs from the 6SE12 Simovert-P be connected to external devices and systems via the relay module – not by direct connection to terminals 26 thru 30 (X14).

The 6SE12 Simovert-P is supplied, standard, with a Relay Module (K1 thru K4) as shown below.

(The relays actually have "form C" contacts internally, but only the normally open contacts are brought out to terminals).

The relay contact ratings are specified on page 2.3.

Relay Driver Outputs and Relay Board



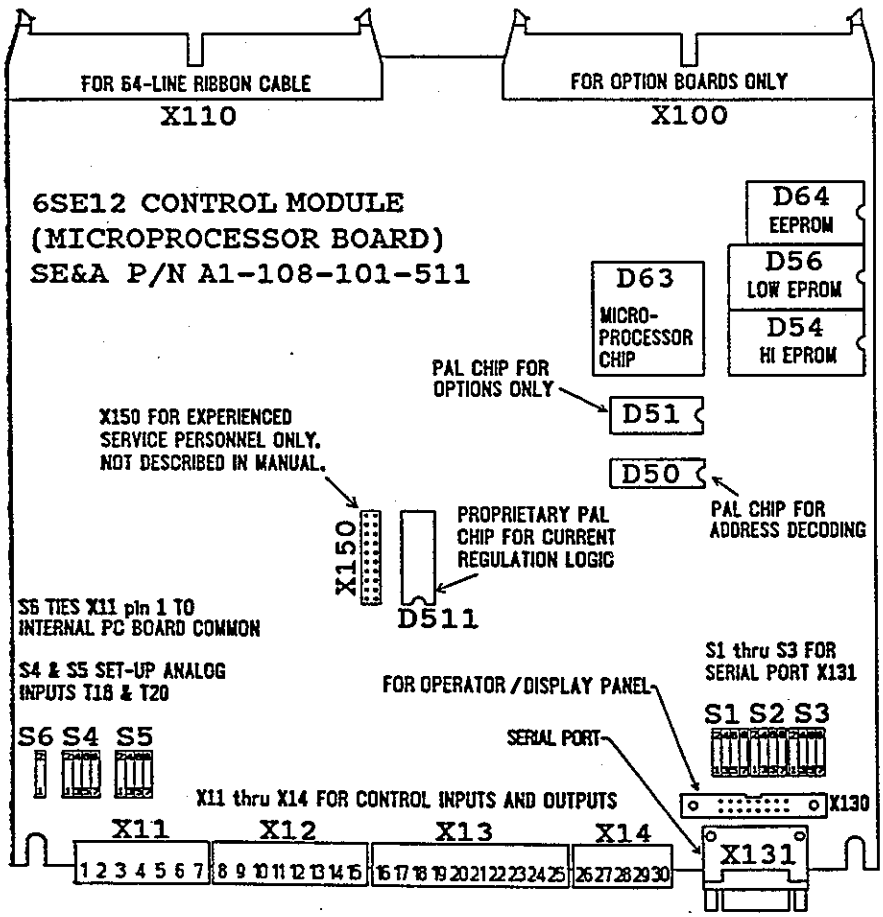
4.7 Serial Interface

The 6SE12 Control Module includes an on-board Serial Interface. This Serial Interface can control operation of the 6SE12 Simovert-P and can also be used to download & upload parameters (i.e. copy & set parameters). The use of the Serial Interface depends on the settings of parameters P015 & P049 and other factors – see Appendix B for details.

There are other Serial Interfaces available on the CS51, PT1, and Z2006 Option Boards. RS485 and other standards, and several protocols are supported. These will not be described in this Instruction Manual. Contact a Siemens Sales Office for more information, or see section 7.7 for technical assistance.

The on-board Serial Interface may be configured for either TTY 20 mA current loop or "RS232 standard" by setting the DIP HOOK switches S1-S3 on the Control Module – see diagram below. The serial connection is made through a nine pin D-Subminiature connector, X131, with the following pin designations :

Pin		
1	M24	(TTY common)
2	TXD/T20	(RS232 transmit or 20 mA transmit source)
3	RXD/R20	(RS232 receive or 20 mA receive source)
4	TTY +	(20 mA transmit input)
5	TTY -	(20 mA transmit output)
6	M24	(TTY common)
7	BE RS232	(RS232 common)
8	RTTY +	(20 mA receive input)
9	RTTY -	(20 mA receive output)



SWITCH SETTINGS FOR TTY 20 mA :

S1				S2				S3			
0	1	0	1	0	1	0	x	0	x	0	1

SWITCH SETTINGS FOR RS232 :

S1				S2				S3			
1	0	1	0	1	0	1	x	1	x	1	0

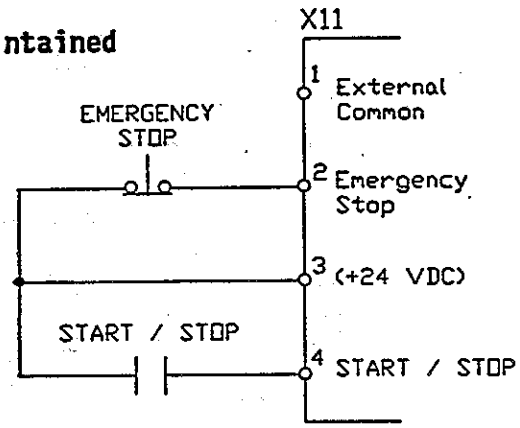
1 = CLOSED
0 = OPEN
x = don't care

6SE12 Control Module – Software Version 3.0 & newer only !

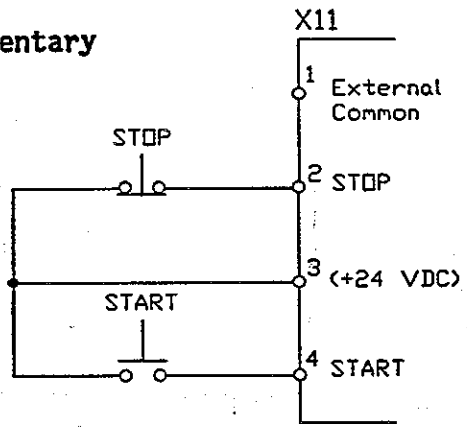
4.8 Summary of Signal Wiring Connections (terminals 1 thru 30)

Start / Stop Inputs :

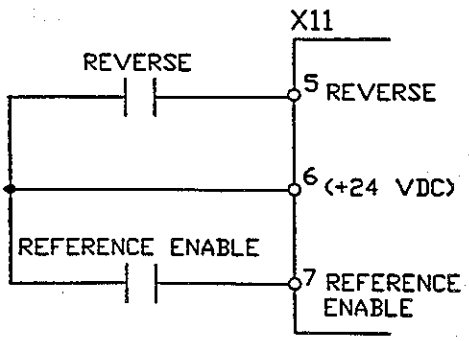
Maintained



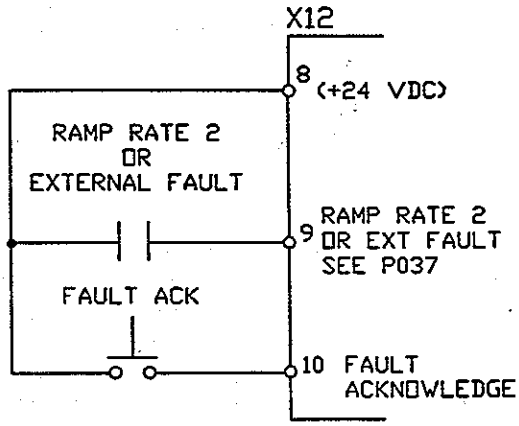
Momentary



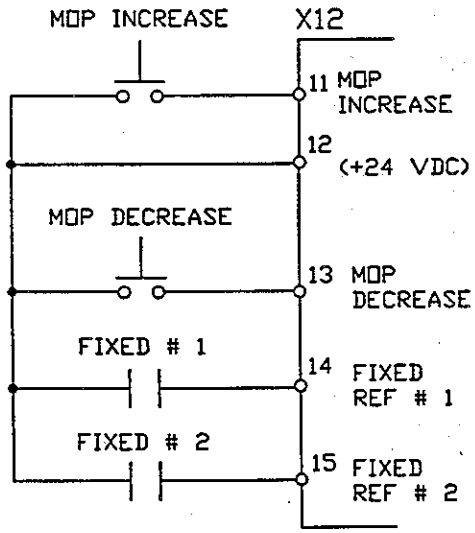
Reverse & Enable Inputs :



Terminal 9 & Fault Acknowledge :



Fixed References & "MOP" Inputs:

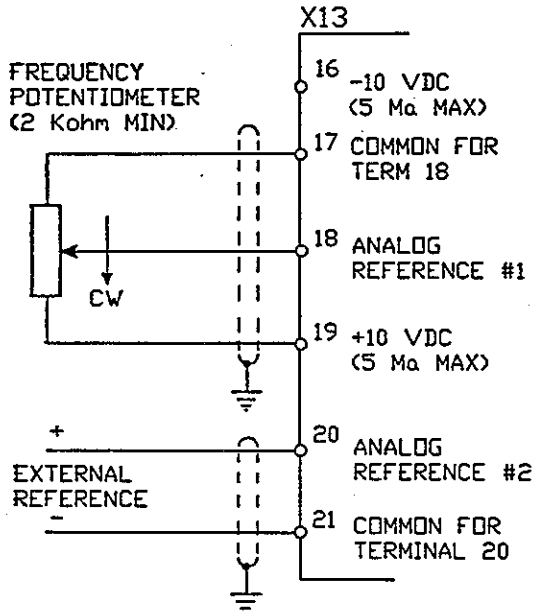


see section 4.6 for more details on all connections

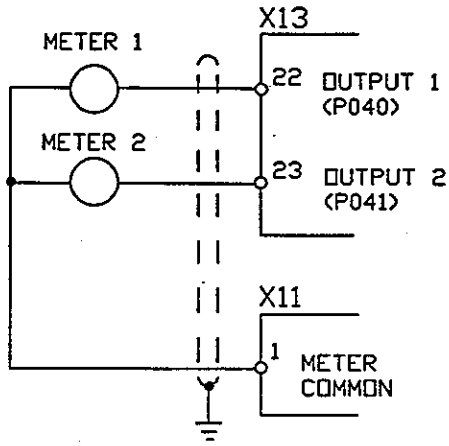
Terminals 16 thru 30 on Next Page

4.8 Summary of Signal Wiring Connections (continued)

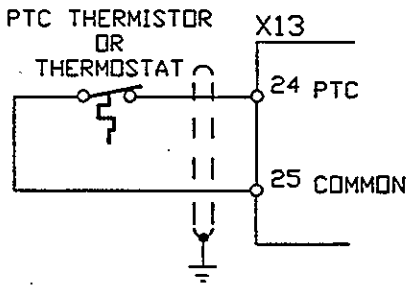
Analog Inputs



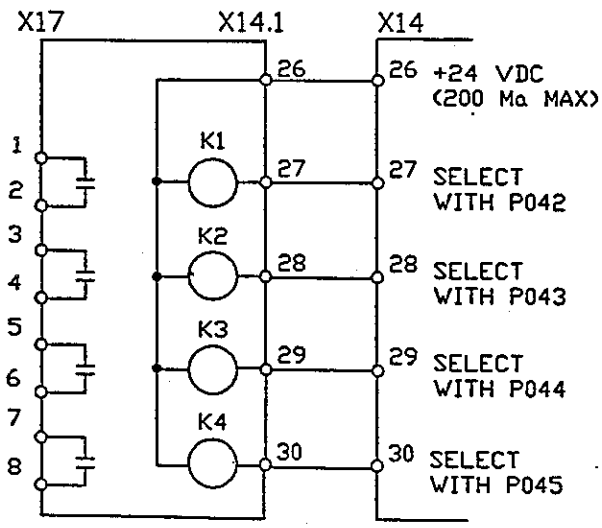
Analog Outputs



Motor Temperature



Relay Driver Outputs & Relay Board



see section 4.6 for more details on all connections

⚠ WARNING

This equipment contains hazardous voltages and rotating parts. Loss of life, severe personal injury or property damage can result if instructions contained in this manual are not followed.

Only qualified personnel should work on this equipment and only after becoming familiar with all safety notices, operation, maintenance, and installation procedures contained in this manual.

5.1 General Information

The Simovert-P controller can be configured and optimized for a wide range of motors and applications. In most cases, the only set-up (programming) necessary is to enter the correct motor data with the Operator Panel Keypad. (Figure 5.1)

The configuration and operating characteristics of the Simovert-P are set by "Parameters". The present value of each Parameter can be displayed and/or changed using the Operator Panel. When a Parameter is changed its new value is stored in the Simovert-P's EEPROM memory, and is not affected by subsequent shutdowns or power outages.

Accidental changes to Parameters are prevented by requiring the setting of a **"Key Parameter"** (Parameter P004) before Parameters can be changed. A few, non-critical, Parameters can be changed without entering a "Key Code" into Parameter P004.

Sections 5.2 thru 5.7 provide detailed instructions on Start-up and "tuning" of the 6SE12 Simovert-P.

5.2 Operator Panel

The Operator Panel consists of an alphanumeric display, five "LED" indicators, and eight push-button keys. See figure 5.1.

Display :

The display is an alphanumeric LCD display with two lines of 16 characters each.

Unless parameters are being changed or a fault is present, the display will be in the "Operating Display" mode. In this case it will continuously display a value selected by Parameter P002: for example, "Output Frequency".

When changing Parameters, the Parameter number, name, and value are shown on the display.

If a fault is present, the fault number and name are displayed.

The symbol in the lower right corner of the LCD display indicates the control source of the inverter and/or the parameter "changeability" status :

Symbol	Control Source / status
blank	Operator Panel
"E"	External via Terminal Block
"S"	Serial Interface
"A"	Automation Option Board
"*"	indicates that displayed value or parameter cannot be changed

LED Signal Lights :

"ON" (steady) :

Indicates The inverter is operating.

(continued on next page)

LED SIGNAL LIGHTS (continued) :

"ON" (blinking) :

Indicates that the DC Link is charged and "ready to go", waiting for an "enable" signal on terminal 7 or by Serial Link or Technology Board. The inverter will run when the "enable" command is present. The inverter will also run if "Preset Speed" terminals 14 or 15 are energized.

"READY" :

The inverter has no faults and is ready to operate. The inverter will charge the DC Link (it takes some time) and then run after the "Start" command is received.

" ↶ " LED :

Reverse direction is selected.

"FAULT" (LED on Steady) :

Indicates a fault. The cause of the fault is indicated on the display.

"FAULT" (LED blinking) :

Indicates a "Warning": The cause of the Warning is displayed by pressing the "R" button.

"PROG" (LED on Steady) :

Indicates the controller is in the Program Mode and that parameters can be selected by the " ↑ / ↓ " Keys.

"PROG" (LED blinking) :

Indicates that " ↑ / ↓ " Keys will change the value of the selected parameter. A flashing cursor will also be displayed under the parameter value when it is allowed to be changed.

PUSH-BUTTON KEYS :

" ↑ " KEY :

In the "READY" or "OPERATE" mode the " ↑ " Key is used to increase the "MOP" reference value. In the "PROG" mode, the " ↑ " Key is used to select the next parameter for display and/or to increase the value of the selected parameter.

" ↓ " KEY :

In the "READY" or "OPERATE" mode the " ↓ " Key is used to decrease the "MOP" reference value. In the "PROG" mode, the " ↓ " Key is used to select the prior parameter for display and/or to decrease the value of the selected parameter.

"P" KEY :

From the "READY" state, pressing the "P" Key once will transfer the display to the program mode. The "PROG" LED will come "on steady" and the display will show the last parameter selected. The " ↑ " or " ↓ " Keys can then be used to move to the desired parameter to be displayed or changed.

When the desired parameter is shown on the display, pressing the "P" Key a second time will cause the "PROG" LED to blink indicating that the parameter can then be changed (provided the key code, P004, and other conditions permit).

Whenever a " ↑ " or " ↓ " Key is pressed and held, and then the "P" key is simultaneously pressed, the corresponding " ↑ " or " ↓ " function will change much faster.

Once the Mode has been reset to "Operate", pressing the "R" key will transfer the display back to the "Operating Display" mode.

"S" KEY :

When in the Parameter Change mode (i.e. the "PROG" LED is blinking), pressing the "S" Key Stores the Parameter value and returns to Parameter Select mode. The "S" Key ("store") must be pressed before any change will be effective.

When in the Operating Display mode, pressing the "S" Key will cause the display to show the present "setpoint or reference". When the "S" Key is pressed again the normal Operating Display value (selected by P002) will reappear. The "S" Key toggles the display from "Operating Display" to "reference or Setpoint Display".

"↺" KEY :

If P015, has been set to "Local" (Operator Panel), and parameter P036 has been set to "Reversing by Reverse Switch", pressing the "↺" Key will reverse the inverter output phase sequence and the motor will reverse. Normal accel/decel ramps are used.

"R" KEY :

This is the Reset Key. The "R" Key "un-does" or cancels the last Key entry (if "S" Key was <u>not</u> pressed).

The "R" Key also causes the mode to revert to the previous mode. For example, if in Parameter Set mode, pressing "R" returns to Parameter Select mode.

If inverter control has been set to "Local" (P015) and a fault occurs, pressing the "R" Key will acknowledge the fault and return the drive to the "Ready" mode.

If no faults are present and control (P015) is "Local", pressing the "R" Key will display the reason for the last Warning. When pressed again the display will return to the Operating Display value. The "R" Key toggles the display between "Operating Display" and "Last Warning".

"I" KEY :

This is the "ON" key. If inverter control has been set to "Local" (P015), pressing the "I" Key when the inverter is "Ready" will cause the inverter to start .

"O" KEY :

This is the "OFF" key. If inverter control has been set to "Local" (P015), pressing the "O" Key will cause the inverter to stop.

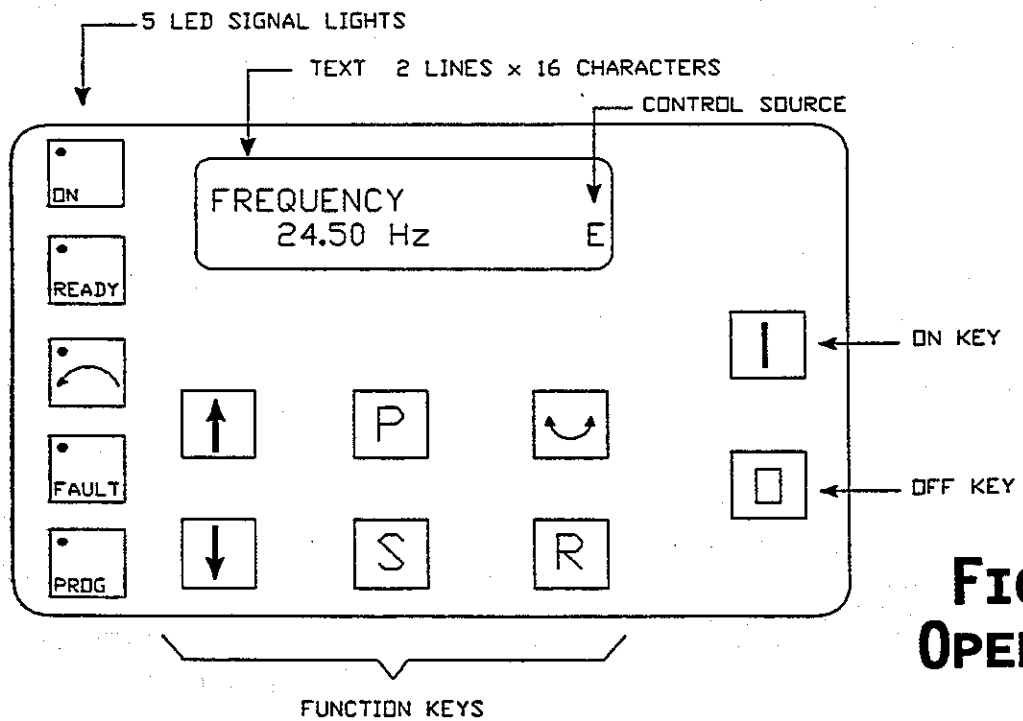


FIGURE 5.1
OPERATOR PANEL

5.3 PARAMETERS, Description/Use

Parameters are used to set-up, or configure the Simovert-P for various operating modes and to optimize the drive for various motors and applications. Normally, the Parameters are displayed and adjusted with the Operator Panel (Figure 5.1). Parameters can also be displayed and adjusted by the Serial Communications Link (Appendix B) and by various Option Boards (not described here).

The Simovert-P has 3 programming states (modes): Operate, Commission, and Initialize. Parameter P003 selects the programming state. In each programming state, only those Parameters associated with that state can be accessed. Also, most Parameters require a special "Key Code" to be entered into Parameter P004 before they can be changed.

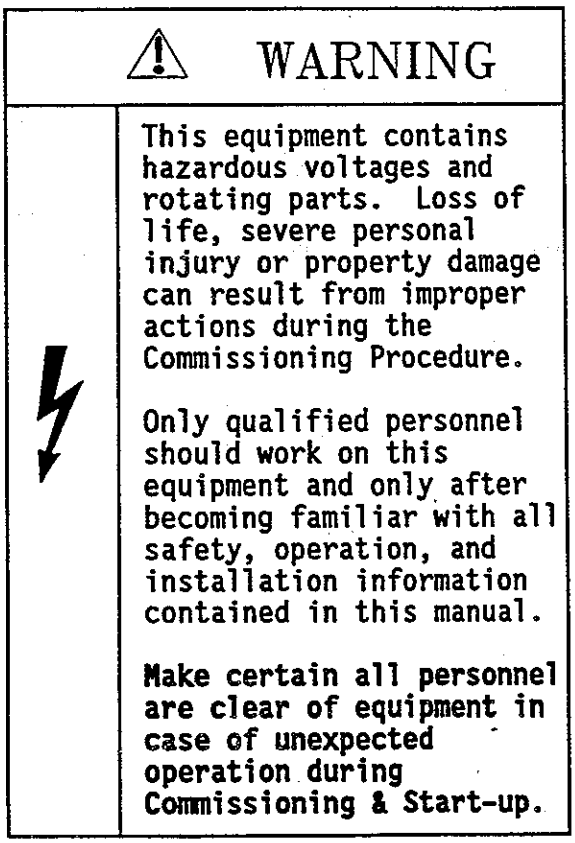
The Operate Mode is the normal programming state that the Simovert-P should be set to when the start-up (commissioning) is finished. Operate Mode is the only mode in which the inverter can be run. Unless a special Key Code is entered in Parameter P004, only certain "display" parameters can be changed when in Operate Mode. If a valid Key Code is entered into Parameter P004, many (not all) Parameters that affect drive operation can be changed in Operate Mode. In Operate Mode, all Parameters can be displayed, but only appropriate Parameters can be changed.

The Commission Mode is used when "commissioning" the Simovert-P, i.e. when setting-up the drive for operation. In Commissioning Mode, Parameters which describe the motor(s) and Parameters that select various operating and control features are entered.

The "Initialize" Mode is intended for factory use only. In Initialize Mode, The KVA and model number are set, and the presence (or absence) of Option Boards is declared. If a new Microprocessor Board (Control Module), or Option Board, or Pulsed Resistor Module is installed in the field; then it will be necessary to "Re-initialize" the Simovert-P. See the appropriate Parameter descriptions (P076, P900, etc.) in chapter 6 for details.

5.4 INITIAL COMMISSIONING

The following Commissioning Procedure assumes that the relevant system configuration decisions have been made and the installation and wiring have been completed per the instructions in chapters 3 & 4 :



1) Apply 460 VAC power to the Simovert-P. The "ON" LED must not come on, if it does, remove the "run" command. Any of the other LED's must come on or, at least, some text must appear on the LCD display at this time. If not, there is a Power Supply failure, or other failure. (Loose cable ?)

(continued on next page)

2) Press the "P" and/or "R" Keys until the "PROG" LED comes on steady.

3) Using the ↑ or ↓ Keys, select Parameter P003 then press the P Key. The "PROG" LED must start blinking at this time.

4) Using the ↑ or ↓ Keys, select "Commission" mode and press the S Key to set Commissioning Mode. If at any time the message "Commissioning, Press P" appears on the display, simply press P as instructed. The "PROG" LED must be on steady at this time.

The previous paragraphs describe the procedure for selecting and then setting Parameter P003. Exactly the same sequence of P, ↑, ↓, and S, Keys is used to select and set any parameter. Use the R Key if you "mess-up".

In summary, to select & then set or change a Parameter, Press the P Key – the "PROG" LED must be on steady. Use the ↑ ↓ Keys to select the desired Parameter. Then press the P Key again and the "PROG" LED must start blinking. Use the ↑ ↓ Keys to select the desired choice or value, then press the S Key to store or "set" the selection.

5) Select Parameter P004, "Software Key" and set the value to 4. "Access Level 1" must appear on the display.

6) Select Parameter P005 and set it as desired. Continue this process for all Parameters thru P919, **or stop at Parameter 11 if all you want is simple, "factory default" operation as described below.**

The factory (default) settings of all of the Commissioning Parameters will allow the Simovert-P to be controlled from the Operator Panel (Figure 5.1) with a minimum frequency of 2 Hz and a maximum frequency of 60 Hz. The Simovert-P will be in V/Hz mode which is suitable for general purpose and multi-motor applications.

The following table shows the minimum Parameters which must be set in order to operate the Simovert-P in "factory default mode" as described in the previous paragraph :

Parameter	Value or Choice to set
P003	"Commission"
P004	4, result: ACCESS LEVEL 1
P005	"Constant Torque" or "Load Adaptive" for Pump and Fan Applications
P006	Nameplate Motor Horsepower
P007	Nameplate Motor Voltage
P008	Nameplate Motor Current
P009	Nameplate Motor Efficiency
P010	Nameplate Motor Frequency
P011	Nameplate Motor RPM's

Additional Parameters (see Detailed Parameter Description chapter 6) can be adjusted if necessary for an individual application, although in most cases the settings listed above are sufficient.

7) When all of the Commissioning Parameters have been set properly, set Parameter P003 to "Operate" mode. After setting P003 to "Operate", the "PROG" LED should go off and the "READY" LED should come on.

Depending on which stop/start, enable, or fault commands were selected during Commissioning, the "READY" LED may not come on.

Some other causes of no "READY" LED are: field wiring errors, faults, and/or no enable command. Also, if some irrational or impossible selections were made during Commissioning, the "ready" LED may not come on.

End of Initial Commissioning

5.5 START-UP (Final Commissioning)

Section 5.5 has four sub-sections which are the detailed "final commissioning" or start-up and tuning procedures for the four basic modes of 6SE12 Simovert-P operation. After reading this section (5.5), you must choose one of the four operating modes and then follow the "final commissioning / start-up" procedure for the particular operating mode that you have chosen.

Control (start/stop, speed, etc.) will be from the Operator Panel if the default commissioning Parameters were used as described in section 5.4. If Parameters P15, 16, 34, 36, 37, 49, or 54 were set to non-default values during Commissioning, then control may be by various digital & analog inputs as described in section 4.6 (Wiring). Also, if an option board (Technology Module), or Serial Communication is used, then refer to appendix B or other documentation for more information.

The following paragraphs will assume that control is from the Operator Panel. Even if you intend to use other control sources it is usually convenient to set the Simovert-P for Operator Panel control for "Initial Start-up", and then, Re-commission the Simovert-P for other control sources for "final operation".

Disconnect (mechanically) the motor(s) from any load(s) that could be damaged by unexpected or unstable operation during Start-up. After you are confident that the motor is operating predictably and stably, the load may be re-connected.

If there are problems in any of the following steps, refer to Fault / Troubleshooting Guide, chapter 7.

Choose <u>one</u> of the following sections (5.5.1,2,3, or 4) as appropriate for your particular "operating mode".

5.5.1 START-UP WITH P050 = V/Hz MODE, P005 = CONSTANT TORQ

1) The "READY" LED must be on; see last 3 paragraphs in section 5.4. Start the inverter by pressing the "|" Key. The motor will then accelerate to minimum speed which should be 2 Hz.

2) With the motor still running at 2 Hz, set Parameter P002 to display "Output Current".

For applications requiring 100% starting torque, the Output Current at 2 Hz should be the Motor Nameplate Rated Current.

If the application does <u>not</u> require high starting torque; smoother, quieter, and cooler operation will result if the current at 2 Hz is less than Motor Nameplate Rated Current.

If the application requires very high starting torque, currents higher than the motor nameplate rating are acceptable <u>if</u> the application will never operate at 2 Hz (low speed) for long periods of time.

3) Adjust parameter P018 to increase or decrease the Output Current at 2 Hz. Make sure that low speed (2 Hz) Output Current is correct (read paragraphs above) before proceeding.

Note: The following paragraphs assume a <u>60 Hz</u>, <u>460 V</u> motor. If <u>other</u> voltages or frequencies are used, the numbers <u>must</u> be scaled appropriately. A qualified technician and a calculator will be required for this.

4) Set Parameter P002 to display "Output Frequency". Using the " ↑ " Key, increase the speed to 50 Hz output frequency. Press the "S" Key to display Frequency Setpoint. The Output Frequency and the Frequency Setpoint must be the same, i.e. <u>50 Hz</u>. If Parameter P023 is set

(continued on next page)

for "Slip Compensation", there may be a slight difference between Output Frequency and Setpoint Frequency.

5) Set Parameter P002 to display "Output Voltage". With the motor running unloaded, at 50 Hz, the voltage should be between 375 V and 390 V. Make sure the 50 Hz Output Voltage is correct before proceeding.

Note: There are no adjustments in steps 5 & 6. If Initial Commissioning (section 5.4), wiring, and motor are good; then steps 5 & 6 should be successful. If steps 5 & 6 are not successful, re-check Commissioning Parameters, wiring, and motor. As a last resort, adjust parameter P007; but this should not be necessary.

6) Set Parameter P002 to display "Output Current". With the motor running unloaded, at 50 Hz, the current should be between 15% and 45% of the Nameplate Rated Full Load Current. Single, high speed motors will have lower no load currents and multiple small motors or low speed motors will have higher no load currents. The important point is that the 50 Hz no load current should be "reasonable" before proceeding.

7) Start and stop the motor and operate it through its speed range. If the operation is stable, proper, and acceptable, then connect the load to the motor.

With the load connected, run the motor at 2 Hz. Make sure the motor is able to drive the load at low speed and that the behavior and the Output Current are "reasonable" before proceeding. Adjust parameter P018 (low speed boost) if necessary.

8) With the load connected, run the motor at 50 Hz. Set Parameter P002 to display "Output Voltage". The Output Voltage should be 375 V to 400 V. If the full load, 50 Hz voltage is not correct, then adjust Parameter P022 (I*R Compensation) until the Output Voltage is correct.

9) Set Parameter P002 to display "Output Current". Make sure the motor is able to drive the load at 50 Hz, full load, and that the behavior and the Output Current are "reasonable" before proceeding.

10) Run the motor at 60 Hz, full load (or whatever is maximum load and speed). Make sure the motor is able to drive the load at full speed and full load; and that the behavior is smooth and stable. Motor voltage at full load at 60 Hz should be between 450 V and 500 V. Current should be "reasonable". Adjust parameter P022 if necessary.

11) If control (stop/start, speed, etc.) needs to be set differently for the application (i.e. final operation), then "re-Commission" Parameters P15, 16, 34, 36, 37, 49, or 54 as required.

12) Verify that the motor and drive are working properly in the "final control and operating scheme".

Note: The only Parameter adjustments described in this start-up procedure were P018 and P022. It is usually not necessary and not recommended to adjust other Parameters. However, some applications may require further "tuning" or special features. Refer to chapter 6, Detailed Parameter Descriptions, for information on Parameters not described in this start-up procedure.

Refer to section 5.6 for additional "hints and comments" on start-up and tuning.

Refer to section 5.7 for a description and comments on "Motor Pullout".

Refer to chapter 7 for fault and troubleshooting, service, and technical assistance information.

End of Start-up (Final Commissioning) with Parameters P050 = V/Hz Mode, and P005 = Constant Torque.

5.5.2 START-UP WITH P050 = V/Hz MODE, P005 = LOAD ADAPTIVE (i.e. Fan/Pump Curve)

1) Follow and complete all steps in Section 5.5.1, Start-up Procedure with Parameter P005 = Constant Torque and P050 = V/Hz Mode.

2) After completing all steps in section 5.5.1, set parameter P003 to Commissioning Mode and then change parameter P005 to "Load Adaptive". Then change parameter P003 back to "Operate" mode.

3) Verify that full-load, full-speed (60 Hz) motor voltage is still correct as described in section 5.5.1. step 10.

4) Operate the motor over it's speed range and verify that operation is smooth and stable from low speed to high speed.

If section 5.5.1 was completed properly and successfully, then the verifications in steps 3 & 4 above should be successful. If not, re-check initial commissioning (section 5.4). If the initial commissioning (section 5.4) and section 5.5.1 were completed properly and successfully; and there is still a problem with the verifications in steps 3 & 4 above; then an adjustment to parameter P022 may be necessary.

Note: When P005 = "Load Adaptive", the "Volts per Hertz" curve is not linear. See parameter P018 on page 6-11 for a graphical representation. The motor voltages at intermediate speeds will be less than when P005 = "Constant Torque".

End of Start-up (Final Commissioning) with Parameters P050 = V/Hz Mode, and P005 = Load Adaptive (Fan/Pump mode).

5.5.3 START-UP WITH P050 = FREQUENCY MODE P005 = CONSTANT TORQ

1) The "READY" LED must be on; see last 3 paragraphs in section 5.4. Start the inverter by pressing the "|" Key. The motor will then accelerate to minimum speed which should be 2 Hz.

2) With the motor still running at 2 Hz, set Parameter P002 to display "Output Current".

Normally (default), the Output Current at 2 Hz will be the Rated Motor Current (P008) which allows for up to 100% starting torque.

If the application does <u>not</u> require high starting torque; smoother, quieter, and cooler operation will result if the current at 2 Hz is less than Motor Nameplate Rated Current.

If the application requires very high starting torque, currents higher than the motor nameplate rating are acceptable <u>if</u> the application will never operate at 2 Hz (low speed) for long periods of time.

3) Adjust parameter P018 to increase or decrease the Output Current at 2 Hz. Make sure that low speed (2 Hz) Output Current is correct (read paragraphs above) before proceeding.

Note: The following paragraphs assume a <u>60 Hz</u>, <u>460 V</u> motor. If <u>other</u> voltages or frequencies are used, the numbers <u>must</u> be scaled appropriately. A qualified technician and a calculator will be required for this.

4) Set Parameter P002 to display "Output Frequency". Using the " ↑ " Key, increase the speed to <u>50 Hz</u> output frequency. Press the "S" Key to display Frequency Setpoint. The Output Frequency and the

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Frequency Setpoint must be the same, i.e. 50 Hz. If Parameter P023 is set for "Slip Compensation", there may be a slight difference between Output Frequency and Setpoint Frequency.

5) Set Parameter P002 to display "Output Voltage". With the motor running **unloaded, at 50 Hz,** the motor voltage (output voltage) should be between 375 V and 410 V.

If the Output Voltage at 50 HZ, with no load is not correct, re-check the "Commissioning Parameters" described in section 5.4. If the Commissioning Parameters are correct, adjust Parameter P022 (magnetizing current correction) until the Output Voltage is correct at 50 Hz, no load.

Note: If Initial Commissioning (section 5.4), wiring, and motor are good; then only a small adjustment, if any, to parameter P022 should be required in steps 5, 6, & 7. If steps 5, 6, & 7 are not successful, re-check Commissioning Parameters, wiring, and motor.

6) Set Parameter P002 to display "Output Current". With the motor running unloaded, **at 50 Hz,** the current should be between 15% and 45% of the Nameplate Rated Full Load Current.

High speed motors will have lower no load currents and low speed motors will have higher no load currents. The important point is that the 50 Hz no-load current should be "reasonable" before proceeding. The motor should also be running "smoothly" and "stably" at 50 Hz, no-load.

7) Set the frequency to 60 Hz. The no load Output Voltage at 60 Hz should be 450 V to 490 V. The no load current at 60 Hz should be about the same as at 50 Hz. Make sure the motor behavior and the no load voltage and current at 60 Hz are "reasonable" before proceeding.

Note: If Parameter P022 was adjusted in the previous steps, then it will affect the low speed current which was adjusted in step 3 of this procedure. Re-adjust the low speed (2 Hz) current as instructed in steps 2 & 3 if parameter P022 was changed.

8) Start and stop the motor and operate it through its speed range. If the operation is proper, stable, and acceptable, then connect the load to the motor.

9) With the load connected, run the motor **at 2 Hz.** Make sure the motor is able to drive the load at low speed and that the behavior and the Output Current are "reasonable" and stable before proceeding.

If necessary, adjust parameter P018 (low speed boost). However, note the cautions and conditions described in step 2 of this procedure.

10) With the load connected, run the motor at 50 Hz. Set Parameter P002 to display "Output Voltage". The Output Voltage should be 375 V to 425 V. If the full load, 50 Hz voltage is not correct, then adjust Parameter P067 (leakage inductance correction) until the Output Voltage is correct.

11) Set Parameter P002 to display "Output Current". Make sure the motor is able to drive the load at 50 Hz, **full load,** and that the behavior and the Output Current are "reasonable" before proceeding.

12) Run the motor at 60 Hz, full load (or whatever is maximum load and speed). The Output Voltage at 60 Hz, full load should be 450 V to 500 V. Make sure the motor is able to drive the load at full speed and full load; and that the behavior and the Output Current are "reasonable" before proceeding. Make further adjustments to Parameter P067, if necessary, to obtain the correct Output Voltage at 60 Hz, full load.

(continued on next page)

Comments and notes:

If any adjustments were made at full load (in step above), disconnect the load and make sure the no load Output Voltage is still correct at 50 Hz and 60 Hz. Re-connect the load and make sure the full load Output Voltage is still correct at 50 Hz and 60 Hz.

Remember, if any changes were made to Parameter P022, it will affect low speed (2 Hz) operation also. Make sure low speed (2 Hz) operation is still correct (i.e. correct Output Current and behavior).

The 6SE12 Simovert-P makes a transition from "open loop" control to "vector control" at 3.00 Hz. Below 3.00 Hz the Output Current is forced to the value set by Parameters P008, P018, and P022 regardless of load. Above 3.00 Hz the "vector control" algorithms begin adjusting magnetizing current to maintain the correct magnetic flux at various loads. Assuming all adjustments described in the previous paragraphs have been made properly, there may still be a "bump" or "jerk" in motor operation as the frequency goes from 2.99 Hz to 3.01 Hz. This is usually not a problem and does not require any adjustments. However, if the application requires a smooth transition from 2.99 Hz to 3.01 Hz, make the following adjustment:

A) Set the frequency to 2.99 Hz. This must be done with Parameter P023 = "No Slip Compensation".

B) Observe that the motor is running smoothly and record the Output Current.

C) Set the frequency to 3.01 Hz. Adjust Parameter P066 until the Output Current at 3.01 Hz is the same as it was at 2.99 Hz. This may require a positive or a negative value for Parameter P066.

The transition from 2.99 Hz to 3.01 Hz should now be smooth and "bumpless".

13) If control (stop/start, speed, etc.) needs to be set differently for final operation; then "re-Commission" Parameters P15, 16, 34, 36, 37, 49, or 54 as required.

14) Verify that the motor and drive are working properly in the "final control and operating scheme".

Note: The only Parameter adjustments described in this start-up procedure were P018, P022, P066, and P067. It is usually not necessary and not recommended to adjust other Parameters. However, some applications may require further "tuning" or special features. Refer to chapter 6, Detailed Parameter Descriptions, for information on Parameters not described in this Start-up procedure.

Refer to section 5.6 for additional "hints and comments" on start-up and tuning.

Refer to section 5.7 for a description and comments on "Motor Pullout".

Refer to chapter 7 for fault and troubleshooting information and service and technical assistance information.

End of Start-up (Final Commissioning) with Parameters P050 = Frequency Mode, and P005 = Constant Torque.

5.5.4 START-UP WITH P050 = FREQUENCY MODE P005 = LOAD ADAPTIVE (i.e. Fan/Pump Curve)

1) Follow and complete all steps in Section 5.5.3, Start-up Procedure with Parameter P005 = Constant Torque and P050 = Frequency Mode.

2) After completing all steps in section 5.5.3, set parameter P003 to Commissioning Mode and then change parameter P005 to "Load Adaptive". Then change parameter P003 back to "Operate" mode.

3) Verify that full-load, full-speed (60 Hz) motor voltage is still correct as described in section 5.5.3. step 12.

4) Operate the motor over it's speed range and verify that operation is smooth and stable from low speed to high speed.

If section 5.5.3 was completed properly and successfully, then the verifications in steps 3 & 4 above should be successful. If not, re-check initial commissioning (section 5.4). If the initial commissioning (section 5.4) and section 5.5.3 were completed properly and successfully; and there is still a problem with the verifications in steps 3 & 4 above; then an adjustment to parameter P022 and possibly P067 may be necessary.

Note: When P005 = "Load Adaptive", The no load voltages at 50 Hz and 60 Hz are not well defined and may be up to 50% less than they would be in "Constant Torque" mode. No load and light load currents will also be less than they would be in "Constant Torque" mode. Motor voltage will be considerably less at no load than at full load – this is normal for "load adaptive" operation. The important point is that the no load voltage should not be "too low" or "too high". "Common sense" and experience must define "too low" and "too high".

End of Start-up (Final Commissioning) with Parameters P050 = Frequency Mode, and P005 = Load Adaptive mode.

5.6 COMMENTS AND HINTS ON COMMISSIONING AND START-UP PROCEDURES

The Commissioning and Start-up procedures described in sections 5.4 and 5.5 assume that control (stop/start, speed, etc.) was set to Operator Panel for the Commissioning and Start-up. If the application (final operation) requires control via the terminal blocks (i.e. remote stop/start control and/or remote speed potentiometer or "MOP" function); then simply connect the control wiring as shown in chapter 4 and set the appropriate Parameters P15, 16, 34, 36, 37, 49, or 54 as required.

It is, of course, possible to complete the entire Commissioning and Start-up procedures with the Simovert-P set-up in it's "final operating" configuration, "Local" control is recommended because of convenience and simplicity.

* * * * * * * * * * * * *

The procedures also assume that it is possible to run the motor loaded and unloaded. It is possible to Commission and Operate the 6SE12 Simovert-P if the motor cannot be easily loaded and unloaded; however, performance will not be optimum. If the application requires optimum performance and good "pullout resistance", then you must be able to load and unload the motor during commissioning.

(comments & hints cont'd on next pg)

To commission a 6SE12 Simovert-P when you cannot load and unload the motor, you will have to make "common sense" modifications to the procedures. The important factors are:

1) Loaded, high speed, voltage must be "reasonable" for the motor and the inverter. Divide the motor nameplate voltage by the motor nameplate frequency to obtain the motor rated "volts per hertz". At high speed the motor V/Hz should be within about 5% of the rated V/Hz. Use parameter P022 to obtain the correct V/Hz. If in Frequency (vector control) mode, and P022 adjustment does not produce the correct V/Hz, then adjust P067 as required.

2) Loaded, high speed, current must be "reasonable" for the motor and the inverter. If current is at or above the inverter rating then "dynamic" and overload capabilities will be limited. If current is over the motor rating, then something is wrong. If the motor is not fully loaded, then current should be less than full rated value.

3) Low speed current must be "reasonable". Sections 5.5.1, 2, 3, and 4 describe procedures for adjusting low speed current.

* * * * * * * * * * * *

If you intend to use features such as "Slip Compensation", "Pullout Protection", "Low Current Limits", "Notch Frequency", etc., it is generally recommended to first get the drive operating properly and smoothly with the following settings:

No Slip Compensation,
No Pullout Protection,
Current Limit Higher than Needed,
and Notch Frequency = 302 Hz.

Then, after the drive is running smoothly and predictably, the special features (above) can be "turned on".

* * * * * * * * * * * *

"Fine tuning" with Parameters P51, 52, 53, 61, 68, 69, 70, and 71 is usually not needed and not recommended. If it is necessary to adjust these parameters, refer to chapter 6 for details.

* * * * * * * * * * * *

The Output Voltages recommended in the Start-up procedures cover a wide range. For example 375 V to 410 V at 50 Hz. In theory, a typical, 460 V, 60 Hz motor should have 383 V at 50 Hz and 460 V at 60 Hz. These values are correct for general applications.

* * * * * * * * * * * *

Note that the Output Voltage display has a significant update time. Watch the display for many seconds for meaningful voltage readings.

* * * * * * * * * * * *

Experience has shown that in applications requiring "high performance", or heavy overloads, or "shock loads"; better results are achieved if the voltages are on the "high side". However, if voltages are adjusted too high, then the drive may actually go into a "false pullout" mode where there is less ability to handle overloads.

In very demanding applications, set the high speed, no load voltage on the "high side" (but not more than 12% too high at most) with Parameter P022 and set the high speed, full load voltage on the "high side" (but not more than 12% too high at most) with Parameter P022 or P067.

Experience has also shown that if "low speed boost", Parameter P018 is set too high, the drive may go into a "false pullout" mode and not be able to handle as much low speed torque as with lower values of P018.

(continued on next page)

In summary, values too high and too low for low speed boost and high speed voltage (Parameters P018, P022 and P067) will result in failure to perform well dynamically or with heavy loads.

* * * * * * * * * * *

Note that the default value for Parameter P019, "Current Limit" is only 100% of the motor rating for a 6SE12 Simovert-P. This means that there is no "overload" current available for acceleration or momentary overloads. For applications requiring accelerating torque and/or overload capability, Parameter P019 will have to be set higher than it's default value.

End of section 5.6 Comments & Hints on Commissioning and Start-up Procedures.

5.7 Comments on "Pullout":

AC motors exhibit a phenomenon called "Pullout" which occurs when the mechanical shaft speed is much lower than the "electrical speed" of the motor voltage and current. i.e. the "slip" is very, very high.

This occurs when the mechanical load is too great for the available voltage and current, or when the acceleration rate is so fast that the "electrical speed" which establishes the rotating magnetic field in the motor stator "gets away from" the mechanical speed of the rotor.

Pullout also occurs when an overload occurs so suddenly that the "vector control" algorithms cannot sense the overload and make corrections to motor current (actually magnetic flux) fast enough to prevent pullout.

The 6SE12 Simovert-P control algorithms always attempt to sense a "pullout" condition and bring the motor back to its desired speed (even if P059 = OFF). However, there are limits to the conditions under which this can occur.

If Parameter P059 is set to "Pullout Protection = Off", then it is possible for a motor to be "pulled-out" (i.e. not turning or turning very slowly) even if the 6SE12 Simovert-P display says the motor is operating properly.

With Parameter P059 set to "Pullout Protection = On", the Simovert-P control algorithms will make their best effort to bring the motor back to speed, but if it cannot be done, the drive will "fault" and indicate fault F014, "Motor Pullout".

To prevent pullout, follow the instructions in section 5.5.(1, 2, 3, or 4 depending on operating mode). Also read detailed descriptions of P018, P019, P022, P067, and especially F014 in sections 6 and 7.

end of section 5.7 and chapter 5

6.1 PARAMETER LIST

Each of the three programming modes (Operate, Commission, and Initialize) allows only those parameters associated with that mode to be changed. Therefore, to change a parameter:

* the correct programming mode must be selected (parameter P003).
* the correct "SOFT KEY" code must be set (parameter P004).
* the inverter must be in "READY" mode in some cases (see last few paragraphs in section 5.4).

Refer to sections 5.2, 5.3, and 5.4 for a detailed description of how to use the Operator Panel Keypad and how to select and change parameters.

The remainder of this chapter is a table of all parameters with the following headings:

PARAMETER DESCRIPTION : This column shows the parameter number and the English language description of that parameter.

PARAMETER SELECTIONS : This column shows the choices that are available for the parameter. Note that the "choice numbers" do not show up on the Operator Panel Display (figure 5.1). However, when the parameters are accessed by serial communication or option boards, the "choice numbers" are significant.

CHANGE CODE : This column shows the programming mode (P003), software key (P004) and other conditions that must be present to change the parameter. Most parameters can be changed in several different modes and conditions - they are all listed in the CHANGE CODE column.

The meanings of the CHANGE CODES are as follows:

Ready = Operate Mode, READY LED on, but inverter not running.

On = Operate Mode, Inverter Running.

Commission = Commission Mode.

Initialize = Initialize mode.

All Modes = All Modes

Software Key: P004 = (required value)

SEE SECTION 6.2 STARTING ON PAGE 6-42 FOR CONDENSED LIST OF PARAMETERS AND PARAMETER DESCRIPTIONS

PARAMETER DESCRIPTION	AVAILABLE SELECTIONS	CHANGE CODE

P0001 LANGUAGE

This parameter selects the language for the text display.	1 Deutsch 2 English	All Modes P004 = any value
Note: After P0001 is changed the inverter must be powered off and then on again before the change in language effective. Note: Other languages are available by "special order". Price/delivery = ?		

P0002 DISPLAY

This parameter is used to select the variable that is displayed on the Operator Panel. The variables have the following meanings:	1 frequency (Hz) 2 motor speed 3 output frequency 4 speed difference 5 output current 6 dc link voltage 7 tach voltage 8 active current 9 output voltage 10 tacho act. aut. Factory = frequency	All Modes P004 = any value

Description of choices:

1) Actual output frequency minus calculated slip.
   When slip compensation is active, the displayed frequency is less than the actual inverter output frequency.
   The true motor speed can be calculated directly using the number of pole pairs of the machine and the displayed frequency.
2) In frequency control mode (P0050 = 1), the displayed speed is equal to the calculated speed of the machine.
   In speed control or torque control (P0050 = 2 or 3) this value is equal to the motor speed as measured by a tachometer.
3) Actual inverter output frequency.
4) Speed Error (Reference - Actual speed).
   In speed control mode, the actual speed is measured by the tachometer. For operation without a tachometer, the actual speed is calculated by the "speed calculator" algorithm in the 6SE12 Simovert-P software.
5) Effective value of inverter output current.
6) DC Link Voltage.
7) Tachometer Voltage (if an analog tach is supplied). This is the Frequency corresponding to the tachometer voltage.
8) Active current supplied to the motor (approximately equal to torque.)
9) Output voltage (±10%).
10) Tach signal from the PT1 or Z2006 board. (Scaled in % of P0918)

PARAMETER DESCRIPTION	AVAILABLE SELECTIONS	CHANGE CODE

P0003 PROGRAM MODE

This parameter is used to select the various Programming Modes, or "states" that the Control Module can be in. See section 5.3 for another description.	1 operate 2 commission 3 initialize Factory = operate	Ready Commission Initialize P004 = any value

The "Operate" mode is used when the inverter is going to be run. This is the only mode that will allow the inverter to be started. Parameters that affect dynamic performance can be adjusted in this mode. Some parameters, like accel/decel rates can only be adjusted when the inverter is not "on".

In the "Commission" mode, motor rating data and other parameters are set. This mode is used only during the initial "commissioning" of the drive.

The "Initialize" mode is used at the factory to set inverter KVA, voltage and model number. These parameters should not be changed unless a Pulsed Resistor Module or Option Module is being installed, or if a Control Module (Microprocessor Board) is being swapped from one model Simovert-P to another.

NOTE!

The "Initialize" procedure will erase all parameters and reset them to the factory default values if parameter P004 = 4. See notes in P076 for how to "re-Initialize" the Control Module without defaulting parameters.

The Parameter Default Procedure is as follows:

1) With the Simovert-P in Operate mode, and with the inverter not on, set parameter P003 to "Initialize".

2) Set parameter P004 (software key) to 4 (access level 1).

3) Set parameter P003 back to "Operate" mode. The message : "Initialization Active" must appear on the display for several seconds. That's all !

While the "Initialization Active" message is being displayed, the parameters are being set to their default values.

Note on calibration of analog inputs: The parameter default procedure described above does not calibrate or "re-calibrate" the analog inputs if parameter P0004 (software key) is set to "4" as instructed and if no parameters (such as P076, P077, or P900) were changed.

Also: If parameter P0004 is set to the "secret factory code" then the analog inputs will be calibrated and some, but not all parameters will be defaulted. **DO NOT DO THIS, DO NOT SET P0004 TO 1375 !**

See P0076 (page 6-37) for information on how to calibrate analog inputs and how to re-initialize without defaulting parameters

PARAMETER DESCRIPTION	AVAILABLE SELECTIONS	CHANGE CODE

P0004 SOFTWARE KEY

This parameter is used to set a "software key" to allow parameters to be changed.	1 to 2000 Factory = 1	All Modes

Description

This parameter is a "key code" that allows certain parameters to be changed when the correct "key code" has been entered.

When P004 is set to 4, "access level 1" is displayed indicating that most parameters can be changed (provided P003 and other conditions are correct).

If P004 is set to any value other than 4, then "access level 0" is displayed indicating that only a few parameters (like P002) may be changed.

To protect the integrity of the key code, the value of parameter P0004 is never directly displayed. Instead, an access level (for example, "access level 1") is displayed. Also, the value read back from a serial interface is one greater than the access level number as described below :

Value of P004 set by Operator Panel or by serial interface	Display on Operator Panel	Value read by Operator Panel or serial interface
1	access level 0	1
4	access level 1	2

For example, if P0004 is set to 4 using the Operator Panel or a serial interface, and later the value is read from the serial interface, the value read would be 2. This difference between the value requested in a change telegram to the drive and the value received in the return telegram from the drive must be handled by the host system.

P0005 MOTOR OPERATION

This parameter is used to set the "flux control" or Volts per Hertz control characteristics.	1 constant torque 2 load adaptive Factory = constant torque	Commission P0004 = 4

Description:

This parameter is used to select various "Vector Control" or "V/Hz control" algorithms. The meaning of parameter P005 depends on the setting of parameter P050. The choices for parameter P005 are described on the next page for the various choices for parameter P050.

P0005 continued:

When P0050 is set to "V/Hz ind motor" or "V/Hz sync motor":

constant torque = Voltage/frequency characteristic for constant torque loads, i.e. constant V/Hz. Full motor torque is always available if needed.

load adaptive = Voltage/frequency characteristic for fan and pump loads. See parameter P0018 for graphical representation.

When P0050 is set to "frequency, speed, or torque" mode:

constant torque = Best dynamic performance for constant torque loads. "Vector Control" maintains constant magnetic flux regardless of load.

load adaptive = Quietest, most efficient operation for fan/pump applications. "Vector Control" reduces motor magnetic flux when load is light.

NOTE ON P0006 THRU P0011

For re-configurable motors (wye/delta switchable motors, pole-changing motors, etc.), the data entered for parameters P0006 through P0011 must correspond to the actual configuration being used. For multi-motor applications, current and power must be the total (sum) of all motors.

PARAMETER DESCRIPTION	AVAILABLE SELECTIONS	CHANGE CODE

P0006 MOTOR SHAFT PWR

This parameter is used to enter the motor nameplate power.	Depends on model number. See below:	Commission P0004 = 4

If P077 = "USA"

Inverter Size:	P0006 Motor Size	Factory Setting
6 KVA units (P074 = 6 KVA)	2 hp to 7.5 hp	5 hp
11 KVA units (P074 = 11 KVA)	5 hp to 15 hp	10 hp
18 KVA units (P074 = 18 KVA)	7.5 hp to 20 hp	15 hp
27 KVA units (P074 = 27 KVA)	10 hp to 30 hp	25 hp
36 KVA units (P074 = 36 KVA)	15 hp to 40 hp	30 hp
52 KVA units (P074 = 52 KVA)	20 hp to 60 hp	50 hp

If P0077 = "Europa"

Inverter Size:	P0006 Motor Size	Factory Setting
6 KVA units (P074 = 6 KVA)	1.5 kw to 5.7 kw	4 kw
11 KVA units (P074 = 11 KVA)	3 kw to 10.3 kw	7.5 kw
18 KVA units (P074 = 18 KVA)	5.5 kw to 17 kw	11 kw
27 KVA units (P074 = 27 KVA)	7.5 kw to 25.4 kw	18.5 kw
36 KVA units (P074 = 36 KVA)	11 kw to 33.8 kw	22 kw
52 KVA units (P074 = 52 KVA)	15 kw to 48.9 kw	37 kw

PARAMETER DESCRIPTION	AVAILABLE SELECTIONS	CHANGE CODE

P0007 MOTOR VOLTAGE

Motor nameplate rated voltage at rated frequency declared in P010. See note on page 6-5.	Range: 150 V to 500 V P077 = USA : Factory = 460 V P077=Europa: Factory = 500 V	Commission P0004 = 4

P0008 MOTOR FL AMPS

Motor nameplate rated full load current. See note on page 6-5.	2.9 Amps to 71.5 Amps depending on drive KVA	Commission P0004 = 4

Inverter Size (KVA Rating)	Range of adjustment P0008 Motor Current	If P077 = USA Factory Setting	If P077= Europa Factory Setting
P074 = 6 KVA	2.9 A to 9.4 A	6.7 A	7.0 A
P074 = 11 KVA	4.9 A to 17.0 A	13.0 A	12.0 A
P074 = 18 KVA	8.1 A to 25.5 A	19.0 A	22.8 A
P074 = 27 KVA	11.6 A to 37.4 A	30.6 A	32.7 A
P074 = 36 KVA	15.6 A to 49.5 A	36.5 A	44.1 A
P074 = 52 KVA	22.0 A to 71.5 A	59.1 A	63.8 A

P0009 EFFICIENCY (%) (For P077= Europa, P009= cosφ power factor)

If P077 = "USA" standards, P009 is motor rated efficiency. If P077="Europa" standards, P009 is motor rated power factor.	Range is 50% to 96% for P077 = USA. Range is 0.50 to 0.96 for P077 = Europa	Commission P0004 = 4

Inverter KVA	P0077 = "USA" Factory Settings	P0077 = "Europa" Factory Settings
P074 = 6.0 KVA	83.0%	0.80
P074 = 11.0 KVA	85.0%	0.83
P074 = 18.0 KVA	86.0%	0.85
P074 = 27.0 KVA	87.3%	0.85
P074 = 36.0 KVA	87.5%	0.86
P074 = 52.0 KVA	89.0%	0.87

Note: For USA models, P009 must be efficiency, not power factor – they are not the same thing !

P009 and other factors determine nominal motor magnetizing current. See note at P022.

P0010 MOTOR FREQUENCY

Motor nameplate rated frequency at voltage declared in P007.	Range : 20 Hz to 200 Hz P077 = USA : Factory = 60 Hz P077=Europa: Factory = 50 Hz	Commission P0004 = 4

PARAMETER DESCRIPTION	AVAILABLE SELECTIONS	CHANGE CODE

P0011 MOTOR RATED RPM

Motor rated speed (RPM) at rated frequency declared in P010.	Parameter range: 100 to 12,000 RPM	Commission P0004 = 4

Inverter KVA	P0077 = "USA" Factory Settings	P0077 = "Europa" Factory Settings
P074 = 6.0 KVA	1720 RPM	1435 RPM
P074 = 11.0 KVA	1720 RPM	1450 RPM
P074 = 18.0 KVA	1750 RPM	1455 RPM
P074 = 27.0 KVA	1760 RPM	1460 RPM
P074 = 36.0 KVA	1760 RPM	1465 RPM
P074 = 52.0 KVA	1760 RPM	1475 RPM

P0012 MIN FREQUENCY

Minimum output frequency. The output will ramp from 0 to MIN FREQUENCY if inverter is started with "0" frequency setpoint. P012 (min frequency) cannot be larger than P014 (max frequency).	Range: 0 Hz to 60 Hz if P077 = "USA" 0 Hz to 50 Hz if P077= "Europa" Factory = 2 Hz.	Ready On Commission P0004 = 4

P0013 FIELD WEAK FREQ

In "Vector Control" mode (see P050), P013 is frequency above which constant flux is no longer maintained– i.e. field weakening. In "V/Hz" mode (see P050), P013 is frequency above which constant V/Hz is no longer maintained – i.e. field weakening.	Parameter range: 20 to 300 Hz If P077 = "USA" Factory = 60 Hz If P077 = "Europa" Factory = 50 Hz	Commission P0004 = 4

P0014 MAX FREQUENCY

Maximum output frequency. The output frequency will not go higher than MAX FREQUENCY, even if frequency setpoint is higher. P014 (max frequency) cannot be less than P012 (min frequency).	Range: 0 Hz to 300 Hz If P077 = "USA" Factory = 60 Hz If P077 = "Europa" Factory = 50 Hz	Ready On Commission P0004 = 4

WARNING : To prevent damage to machinery, never set P014 higher than the maximum safe mechanical speed of the motor and/or the machine !

PARAMETER DESCRIPTION	AVAILABLE SELECTIONS	CHANGE CODE

P0015 OPERATE SOURCE

Determines the source of the stop/start, forward/reverse, ↑ ↓ (MOP function), and fault acknowledge commands. See more detailed description below :	1 local 2 maintained sw (switch) 3 momentary pb (pushbutn) 4 autom. warning 5 autom. fault Factory = local	Ready Commission P0004 = 4

Description of choices:

1) "Local" In "local" there are two possible modes of operation (a & b):

a) If the serial interface on the Control Module (figure x.x) is active (i.e. telegrams being exchanged), then stop/start, fault acknowledge, ↑ ↓, speed setpoint, etc, control is automatically transferred to the serial host system. In this case parameters P0016, P0017 and P0036 are not used and have no effect. Operating control via the serial port takes precedence over the Operator Panel (figure 5.1).

b) If no connection is made to the serial interface, or if it does not respond every 100 milliseconds, (cable break, etc.), operating control is automatically transferred to the Operator Panel. In this case, all control functions listed above are controlled by the keys on the Operator Panel. If P0016 = 1, 4 or 5, the speed reference is also set by the Operator Panel (i.e. ↑ ↓ MOP function) .

2) "maintained sw"

In this case the inverter can be started and stopped using maintained contacts connected to terminal 4. Fault acknowledgment occurs via terminal 10, direction of rotation via terminal 5, and speed setpoint is via terminals 11/13 or 18/20 (depending on P0015 and P0016).

3) "momentary pb"

In this case the inverter can be started and stopped using momentary contacts connected to terminals 4 and 2. Otherwise this is the same as choice 2, above. Terminal 2 must be "logic high" in order to start the drive. A positive transition on terminal 4 will start the drive and a negative transition on terminal 2 will stop the drive.

4) "autom. warning"

In this case the inverter is operated and controlled using the optional CS5 communication or PT1 or Z2006 technology modules. Parameters P0016, P0017 and P0036 are not evaluated and only terminals 2, 9 (external fault), and 24 are active. If the communication to the CS5 or PT1/Z2006 module is disrupted, a warning W028 (PROCESS DATA) is activated and the drive continues to use the last valid data received from the CS5 or PT1 or Z2006 module. If the CS5 module is used, disruption of communication on the serial port used for control information (see parameter P0915, index 0 or 16) will result in warning W028.

continued on next page (choice 5)

P0015 OPERATE SOURCE (description continued from previous page)

5) "autom. fault"
This choice is identical to choice "4" except if the communication to the CS5 or PT1 or Z2006 module is disrupted, a fault F028 (PROCESS DATA) will be activated and the drive will stop.

PARAMETER DESCRIPTION	AVAILABLE SELECTIONS	CHANGE CODE

P0016 SPEED REFERENCE

This parameter is used to select the source of the speed or frequency reference. See notes in P017 description for details on using and verifying "summed" inputs.	1 mop 2 anlg T18+20 3 anlg 4ma T18+20 4 mop + T18 5 mop + T18 (4ma) Factory = mop	Ready Commission P0004 = 4

P0016 is only evaluated when P0015 is set to choice 1, 2, or 3.

Description of choices:

1) The setpoint is internally generated using a motor operated potentiometer function. The rate of change of the setpoint is set by P048 (mop speed). See P017 for description of "mop function" and "mop memory".

2) The setpoint is formed by summing the two analog inputs at terminals 18 and 20. With this choice (2) the analog inputs are scaled for 0 to 10 V or 0 to 20 mA. See section 4.6.2 for set-up of analog inputs.

3) Same as choice 2 above except a "software offset" is set for 4 to 20 mA or 2 to 10 V analog signal ranges.

4) The setpoint is the sum of the "mop function" described in choice 1 above and the analog value of terminal 18 as described in choice 2 above.

5) The setpoint is the sum of the "mop function" described in choice 1 above and the analog value of terminal 18 as described in choice 3 above.

Notes :

Scaling of the analog inputs is such that 10 V or 20 mA represents a 100 % input on terminal 18 (100 % of value set in P014). The scaling is the same with terminal 20 if P025 = 100 % (see P025). This scaling depends, of course, on hardware switches SW4 & SW5. See section 4.6.2 for details.

In speed or torque control modes, (P050 = 2 or 3), if analog speed feedback is used, it is connected to terminal 20. Therefore the setpoint is defined only by terminal 18. Important : use of analog speed feedback is not recommended – see note 1 on page 1-4 for explanation.

PARAMETER DESCRIPTION	AVAILABLE SELECTIONS	CHANGE CODE

P0017 MOP FUNCTION

This parameter controls the "memory" feature of the "MOP function". See description below :	1 without memory 2 with memory Factory = without memory	Ready On Commission P0004 = 4

P0017 is only evaluated if P015 = 1, 2, or 3 and P016 = 1, 4, or 5.

The "MOP" function simulates a mechanical motor operated potentiometer. The "value" of the "MOP" may be used as the setpoint for the Simovert-P if P015 and P016 are set appropriately. See descriptions of P015 and P016.

Description of choices:

1) The "MOP value" is increased or decreased by the ↑ ↓ keys or terminals 11 & 13 (see P015). The "MOP value" remains unchanged unless and until an increase or decrease command is received, as long as the Simovert-P is "On" (i.e. inverter is running). If the Simovert-P is "not On" (i.e. "Ready"), or if there is an interruption of incoming AC line power, then the "MOP value" is reset to the value of P012 (minimum frequency). When the Simovert-P is again turned on, "MOP value" will remain at (minimum frequency) unless/until ↑ key is pressed or terminal 11 is energized.

2) Choice 2 is the same as choice 1 above, except, the "MOP value" remains unchanged if the inverter is turned off or if there is an interruption of incoming AC line power. When the Simovert-P is turned on or when power is restored, the "MOP value" will still be the last value that it was set to. (it is stored in non-volatile memory)

Notes :

Operation with P016 = "analog input + mop" and the Interaction with P012, P014, and P036 (min/max frequency & reversing) is somewhat complicated, but it is rational. The following examples will help describe the operation :

If analog input is at +60% and MOP is used to bring motor speed down to -10%; then if analog signal is removed (set to zero), the motor will run at -70% speed because value of MOP is "-70%". (minus speed = reverse)

If P036 = "reversing not allowed", and analog input is at +60%, and MOP is used to bring motor speed to zero; then analog signal is removed; the value of MOP will still be -60% even though reversing is not allowed. Then, if MOP is used to increase motor speed with analog input still at zero, remember that MOP will have to ramp-up from -60% before there is any noticeable result – and that will take significant time.

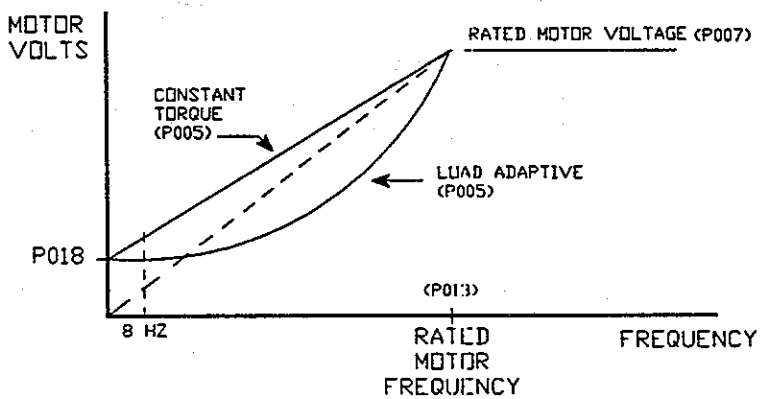
Before running the motor, observe & verify setpoint operation by pressing the "S" key to display setpoint. Exersize the analog inputs and mop (↑ ↓ function) through their ranges while observing the setpoint display. Notice that the true, total, setpoint is limited by P012, P014 and P036); although either the mop or one analog input may be outside the limits.
It is recommended that analog scaling and offset be verified with P016 set to 2 or 3 before setting P016 to 4 or 5.

PARAMETER DESCRIPTION	AVAILABLE SELECTIONS	CHANGE CODE

P0018 BOOST Iu / BOOST V

If P050 = "V/Hz" mode, P018 is low frequency voltage boost. If P050 = "Vector Control" mode, P018 is low frequency current boost.	If P050 = "V/Hz" mode, range is -25% to +25%. If P050= "Vector Control" range is -50% to +100%. Factory = 0% (all modes)	Ready On P0004 = 4

When P050 = "V/Hz" mode (see P050 choices 4 & 5), P018 is as follows :

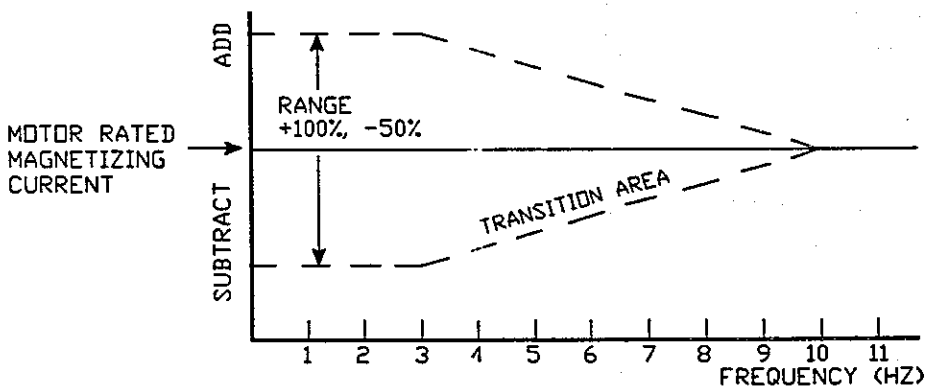


Note: negative values of P018 do have some effect on boost. This is not shown on graph.

The graphical representation above is only a "theoretical" representation of the behavior of P018. With the 6SE12 Simovert-P, "Voltage" is a calculated value derived from current and other factors. P018 adjusts the "low speed boost" as shown above. P018 has maximum effect at 0 Hz and no effect at rated motor frequency. Positive values of P018 have a great effect on "boost", i.e. small increases in P018 will result in large increases in low speed motor current. Negative values of P018 have a small effect.

See additional notes on P018 at the end of the P018 section on next page.

When P050= "Vector Control" (P050 choices 1,2,3,6), P018 is as follows :



Normaly, with P018 and P022 at 0%, the 6SE12 forces 100% rated motor current (set by P008) into the motor at all frequencies below 3 Hz. P018 makes an adjustment of -50% to +100% to the nominal (100%) current below 3 Hz. P018 has full effect at 3.01 Hz, and linearly decreases to no effect above 10 Hz.

See additional information on P018 continued on next page