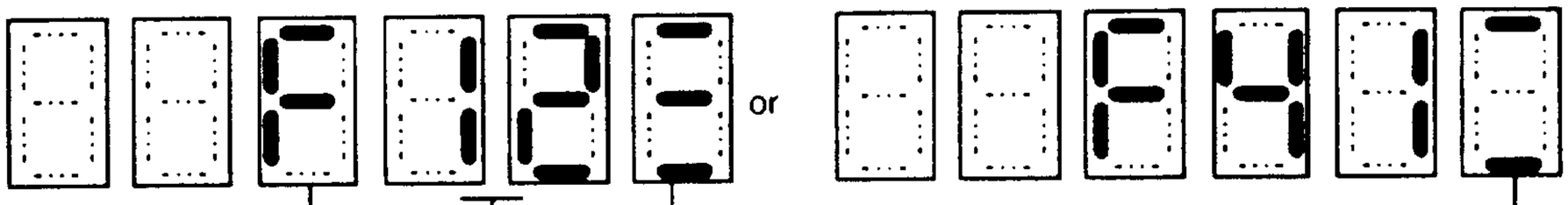
4 Faults

4.1 Fault display

When a fault occurs, the fault program is selected per software instead of the operator control program. The fault is indicated by the following flashing symbols:



4.2 Faults after switch-on

When the operating display LED remains dark after switch-on, this can involve the following faults:

- Motor protection circuit-breaker not switched-in
- At least two phases missing
- At least two incoming fuses have blown
- Power supply fuses on the gating board A0 in the infeed/regen. feedback unit blown *)
- The connection between the display board H1 and control board N1 faulted
- 5 V power supply faulted
- Control board N1 defective

The following faults might have occured when all display LEDs (8.8.8.8.8.8.) are lit after the unit is switched-on:

- Defective control board N1
- EPROM on the control board N1 incorrectly inserted or defect
- No input/output board initializing pulse

4.3 Faults after controller enable

The motor phase sequence is incorrect (2 phase connections interchanged) if the motor has a maximum speed of 10 RPM at a setpoint input n* > 0.2 V, or the motor oscillates (oscillation not preselected) at n* < 0.2 V.

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*) *only for 6SC6502 and 6SC6503*

4.4 Fault signal list

For fault finding, the equipment should be checked in the sequence in which it is listed.

Fault signal	Fault	Cause
F-01	Supply fault	· Pulse cable U4-X117→G02-X117 not inserted *) · Phase missing · Fuse F1, F2 or F3 blown · Fuse F4, F5 or F6 on A0 blown *) · A0 defective or not correctly inserted *) · U1 defective or not correctly inserted · N1 defective or not correctly inserted
F-02	Incorrect phase sequence	· Incorrect supply phase sequence (supply connection)
F-11	Speed controller is at its limit, speed actual value missing	· Motor encoder connector not inserted · Connecting cable to the encoder interrupted · Defective encoder · Defective ribbon cable or cable not correctly inserted · Motor ground not connected · Motor not connected or phase missing · Motor rotor blocked · U1 defective · Gating unit - EPROMs defective · Defective power supply for the gating or gating board · DC link fuse blown
F-12	Inverter overcurrent	· Incorrect motor/converter assignment · Short-circuit/ground fault at the converter/motor · Defective current sensor, U12, U13 · Ribbon cable defective or not correctly inserted · U1 defective · N1 defective · M_d limit set too high (e.g. P-39) · Defective inverter transistor
F-14	Motor overtemperature	· Motor overloaded · Motor current too high, e.g. due to incorrect motor data in P-96 · Defective PTC thermistor (motor) · Defective motor fan · U1 defective · Motor winding short-circuit
F-15 ***)	Converter overtemperature	· Converter overloaded (incorrect motor/converter assignment) · Ambient temperature too high · Fan failed · Defective PTC thermistor · Motor protection circuit-breaker Q1 or Q2 tripped**)
F-19	Temperature sensor interrupted	· NTC thermistor defective (motor) · Sensor connection interrupted · Temperature below - 20 °C · U1 defective

*) *Only for 6SC6502 and 6SC6503*
**) *For converters 6SC6504/06/08/12/20 from June 1990.*
***) *Fault signal F15 can be suppressed via P-19 (refer to Section 3.3.9).*

Fault signal	Fault	Cause
F-40	Internal power supply faulted	- P15 - P10 missing or - N10REF faulted - P5 - P24 - G01 defective - G02 defective - U1 defective - Ground fault, motor phase (low-ohmic < 10 kΩ)
F-41	DC link overvoltage	- DC link capacitors defective - Temporary supply overvoltage - Defective voltage sensing on A0*), or G01, or U1 - Incorrect motor/converter assignment - Supply failure during regenerative operation - Sporadic fault due to the encoder or encoder cable - Defective diode V9 of V10**) or chopper module V1 (+V11****) V5 (+V55****)) - Direct ground fault, motor phase - Motor breakdown torque exceeded (P-176 too large) - Thyristor defective
F-42	DC link overcurrent	- Converter overloaded - A0 defective *) - Current transformer U11 defective - Chopper transistors V1 (+V11****), V5 (+V55****) defective - Thyristor defective - Short-circuit in the DC link - U1 defective - N1 defective - Power section ground fault (V1-V8) - Motor breakdown torque exceeded (P-176 too large) - Motor ground fault
F-48*)**		
F-51	DC link overvoltage	- N1 defective, otherwise as for fault message F-41 - U1 defective
F-52	DC link undervoltage	- Temporary supply dip - A0 defective *) - G01 (G02*)) defective - U1 defective
F-53	Charge fault (DC link)	- Thyristor firing pulses removed A0-X13, -X14 *) - A0 defective *) - G02 defective *) - G01 defective - U1 defective - N1 defective - DC link capacitors defective

*) *Only for 6SC6502 and 6SC6503*
**) *Only for 6SC6512 and 6SC6520*
***) *Fault signal F-48 is omitted from software release 09 onwards*
****) *Only for 6SC6520*

Fault signal	Fault	Cause
F-54	Supply fault	· 45 Hz > supply frequency > 65 Hz · High supply frequency fluctuations · Supply synchronizing voltage missing · A0 defective *) · U1 defective · N1 defective
F-55	Erroneous setpoint calculation	· Values entered in the EEPROM exceed the limit values (initialization necessary)
F-56**)**	Supply frequency timer failed	· N1 defective · U1 defective · G01 defective
F-57	Frequency sensing in the PLL circuit faulted	· N1 defective
F-61	Maximum motor frequency exceeded	· Excessive motor frequency input from the control processor · Excessive maximum motor speed entered in P-29
F-64	Gating unit EPROM incorrect or defective	· EPROMs D76 and D78 on N1 defective
F-71	EPROM sumcheck error L byte, control processor	· EPROM D82 on N1 defective
F-72	EPROM sumcheck error H byte, control processor	· EPROM D80 on N1 defective
F-73	EPROM sumcheck error L byte, gating unit processor	· EPROM D78 on N1 defective
F-74	EPROM sumcheck error H byte, gating unit processor	· EPROM D76 on N1 defective
F-75	EEPROM sumcheck error	· Memory error in the EEPROM (initialization required) · EEPROM D74 defective
F-77	Initializing pulse missing	· Control board N1 not correctly inserted · Input/output U1 not correctly inserted · U1 defective
F-78	On/off program processing time exceeded	· EEPROM D74 error (Initialization required or EEPROM must be replaced)
F-81	DC link overvoltage	· G02 defective · A0 defective *) · U1 defective

*) *Only for 6SC6502 and 6SC6503*

**) *Fault signal not available from software release 12 (refer to Section 4.7.3)*

Fault signal	Fault	Cause
F-91	No-load voltage greater than the rated voltage	Motor data incorrectly entered. New entry necessary
F-92	Rated flux less than the flux at f = 125 Hz	
F-93	2nd transition frequency less than 1st trans. freq.	
F-94	2nd transition frequency less than rated frequency	
F-P1	Unattainable position setpoint	
F-P2	Zero mark missing	

4.5 Fault acknowledgement

Faults can be acknowledged as follows:

- **Parameter key**

By depressing the parameter key with controller inhibit. Both outside displays are switched dark during acknowledgement. A return is made to the operator control program after acknowledgment if no additional fault is present.

- **Remote acknowledgement 1**

With the change from controller enable (terminal 64) to controller inhibit with DC link voltage available.

This type of acknowledgement is only effective when 0 0 $\underline{2}$ 0 H is set in parameter P-53.

- **Remote acknowledgement 2**

When controller inhibit is available and terminal "R" (reset) is activated.

- **Automatic acknowledgement of fault messages F-01 and F-02**

After brief voltage failures, whereby the electronics power supply is buffered from the DC link, fault messages F-01 and F-02 can be automatically acknowledged by appropriately setting bit 6 in parameter P-53 (refer to Section 3.3.9) at controller inhibit.

- **Switch-off**

Switch the unit off and on again.

4.6 Selecting the operator control interface

The operator control program is returned to by depressing the parameter key after acknowledgement has been made with the controller inhibit function. Acknowledgement using this function can be identified with the non-flashing fault display.

When a fault is present, the operator control program can be selected for approx. one minute by briefly depressing the "–" key.

4.7 Diagnostic aids

4.7.1 Measuring sockets and LEDs

Measuring sockets and LEDs, as additional diagnostic aids, are available on the control and input output board in addition to the display.

The functions of the LEDs and the use of the control board measuring sockets (refer to Fig. 4.2) are described in Section 3.3.12.

The following values can be measured via the input/output board sockets:

I_R : Motor current in phase R
I_S : Motor current in phase S
I_T : Motor current in phase T
I_D : DC link current

Converter	I_R, I_S, I_T	I_D
6SC6502	5 V ≙ 45 A	10 V ≙ 75 A
6SC6503	5 V ≙ 70 A	10 V ≙ 75 A
6SC6504	5 V ≙ 90 A	10 V ≙ 90 A
6SC6506*)	5 V ≙ 140 A	10 V ≙ 140 A
6SC6508	5 V ≙ 180 A	10 V ≙ 180 A
6SC6512	5 V ≙ 333 A	10 V ≙ 333 A
6SC6520	5 V ≙ 500 A	10 V ≙ 500 A

I_{WR} : Absolute motor current
Rectification of the actual values of the three phase currents (I_R/I_S/I_T)
M : Reference potential

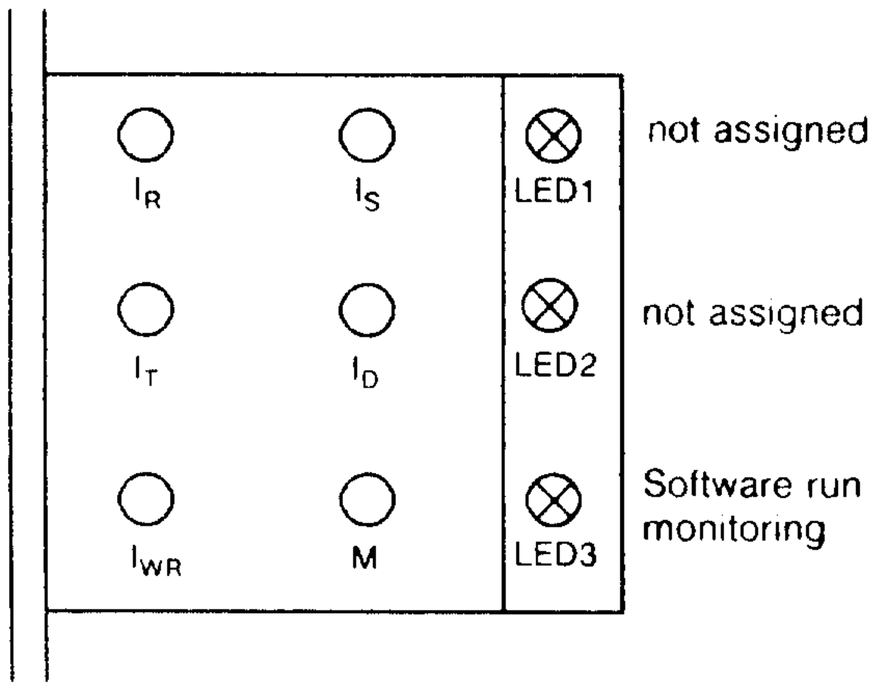


Fig. 4.1 Location of the measuring sockets in the front panel of input/output board U1

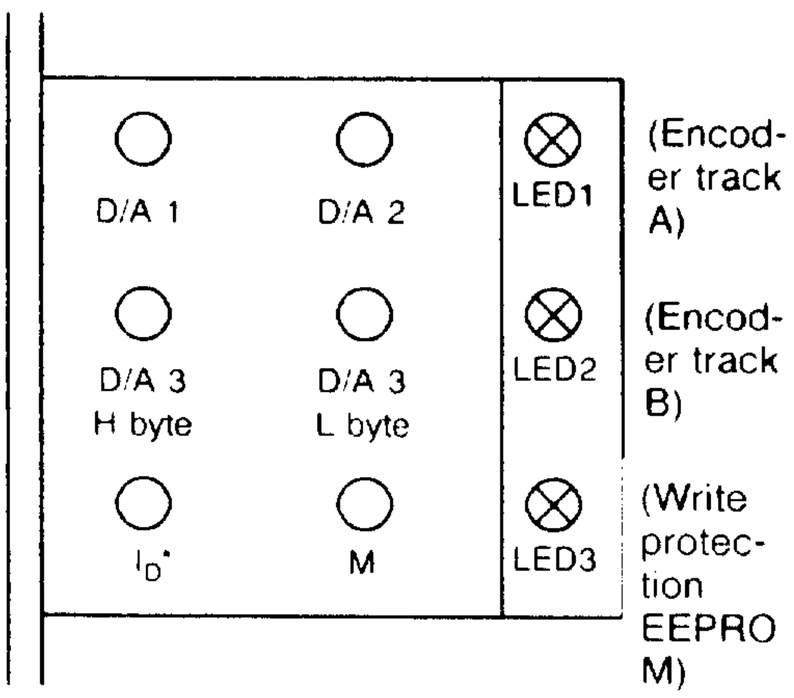


Fig. 4.2 Location of the measuring sockets in the front panel of control board N1

*) For converters 6SC6506-4AA00-0: 5 V ≙ 180 A | 10 V ≙ 180

4.7.2 Transistor diagnostic parameters

(P-70) The transistor diagnostic parameter P70 is available for transistor monitoring.
Parameter contents which are not equal to 0 0 0 0 H can be caused by the following:

Gating board A1 defective
Power supply for A1 missing
Transistor in the inverter module defective
Input output board U1 defective

When a transistor monitoring function responds, the parameter contents change from 0 0 0 0 H into the appropriate transistor value.

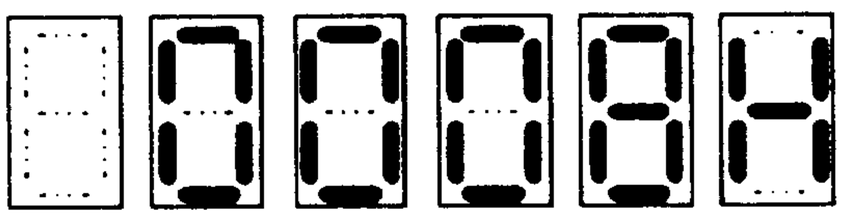
Phase U2	0 0 0 1 H	Transistor V2 (+ V22**) (module V2)*) faulted
	0 0 0 2 H	Transistor V6 (+ V66**) (module V2)*) faulted
Phase V2	0 0 0 4 H	Transistor V3 (+ V33**) (module V3)*) faulted
	0 0 0 8 H	Transistor V7 (+ V77**) (module V3)*) faulted
Phase W2	0 0 1 0 H	Transistor V4 (+ V44**) (module V4)*) faulted
	0 0 2 0 H	Transistor V8 (+ V88**) (module V4)*) faulted
Chopper	0 0 4 0 H	Transistor V1 (+ V1**) faulted
	0 0 8 0 H	Transistor V5 (+ V5**) faulted
	0 0 F F H	A1 power supply missing

The parameter contents are reset to 0 0 0 0 H when a fault is acknowledged or by switching the unit off and on again.

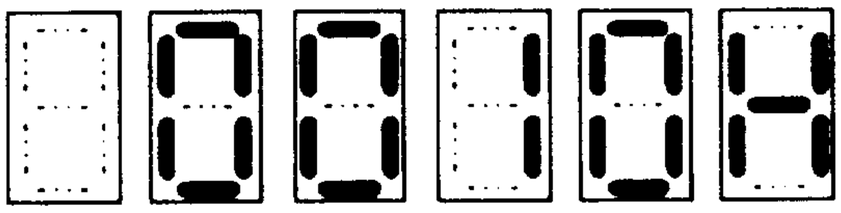
If several transistor monitoring functions have responded simultaneously, then other parameter contents are possible.

4.7.3 Fault flags

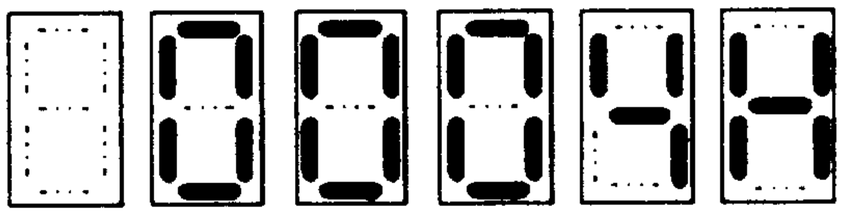
(P-28) Fault signals are stored in P-28 which do not lead to shutdown (pulse inhibit)



Calibration error in the DC link voltage actual value sensing



P-24 V external power supply faulted



Fault identification with the supply frequency sensing (previously "F-56")

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*) *Only valid for 6SC6502 to 6SC6506*

**) *Only valid for 6SC6520*

4.7.4 Speed actual value fault counter

P-20 Parameter P-20 is used for speed sensing monitoring.

The contents of P-20 is increased by 1 if a speed difference of approx. 100 RPM is identified within the sampling time (3ms).

Sporadic counting by a few increments is insignificant as the speed controller is not influenced.

If the contents of P-20 are continuously increased by several increments, a significant fault level is present.

The causes can be:

- Encoder screen not grounded (refer to Section 2.2.1)
- Defective encoder
- The power supply M potential (electronics ground) is not connected to PE (housing) (refer to Section 2.2).
- Motor ground is not connected to the converter

4.7.5 Minimum/maximum value memory (from software release 09)

Parameters P-181, P-182 and P-183 are available for monitoring several variables (RAM data cells).

P-181 Address of the variable to be monitored.
The parameter contents can be stored in the EEPROM.

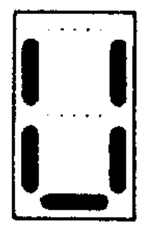
P-182 Minimum value

P-183 Maximum value

The memory function is re-started by changing the address in parameter P-181 and re-entering the original address.

4.7.6 Voltage-frequency (U/f) open-loop control

P-184 U/f open-loop control is selected if this parameter is set to 0 0 0 1 H. It is indicated via P-00, 3rd digit.

Symbol 

The speed actual values (address 0 D 3 4 H from software release 08 onwards) and the inverter current actual values can be checked in this operating mode.

Note:

1) Speed setpoint steps with low ramp-up time (P-16, P-17) lead to fault signals (F-41).
2) Terminal 62 (TH = 0) is ineffective.
3) The setpoint is also controlled via the selected ramp (P-17) when using terminal 81.
4) With the same setpoint voltage, the same speed is not set as in the speed closed-loop control mode.
5) The speed actual value must be positive for a positive speed setpoint (indicated via P-02 from software release 09 onwards). The motor phase sequence must be changed if this is not the case.
6) The parameter should only be changed in the controller inhibit mode, otherwise the setpoint input will be erroneous.

5 Maintenance

WARNING

This electrical equipment contains hazardous voltages.

Death, severe bodily injury or material damage can occur if this equipment is not correctly handled.

Please observe and follow the Servicing Instructions for the equipment specified in this section and on the product itself.

Only appropriately qualified personnel should service the equipment.

Before carrying out any work on the equipment it should be disconnected from the supply, locked-out against re-closure and grounded.

Even after the equipment has been switched-off, a dangerous voltage is available for approx. 4 minutes as a result of the DC link capacitors.

Even when the motor is stationary equipment components can still be live.

5.1 Inspection and service

The converter is maintenance-free when the specifications and instructions given in Section 2.1 are observed.

If the equipment becomes dirty, it is recommended that it is cleaned with dry, oil-free compressed air to prevent flashover and restricted cooling.

5.1.1 Maintenance of the E45 external heat dissipation option

- Operation and maintenance of the standard filter element.
  The intervals for cleaning the filter element are dependent on the degree of pollution, but however should not exceed 3 months. The element must be cleaned if dust deposits etc. restrict the cooling airflow, as otherwise the unit will be shutdown with fault F-15 (overtemperature).
- The filter element can be cleaned as follows:
  Rinse-out using water (up to approx. 40 °C = 104 °F, if necessary using a gentle detergent). The filter can also be cleaned by beating it, vacuuming or blowing out with compressed air. For greasy dust deposits the element can be cleaned in gasoline or in warm water with a grease dissolving solution. The element should not be wrung-out or exposed to powerful water jets!
  The element can be used a multiple number of times when carefully handled: depending on the cooling air quality, up to 10 x.

