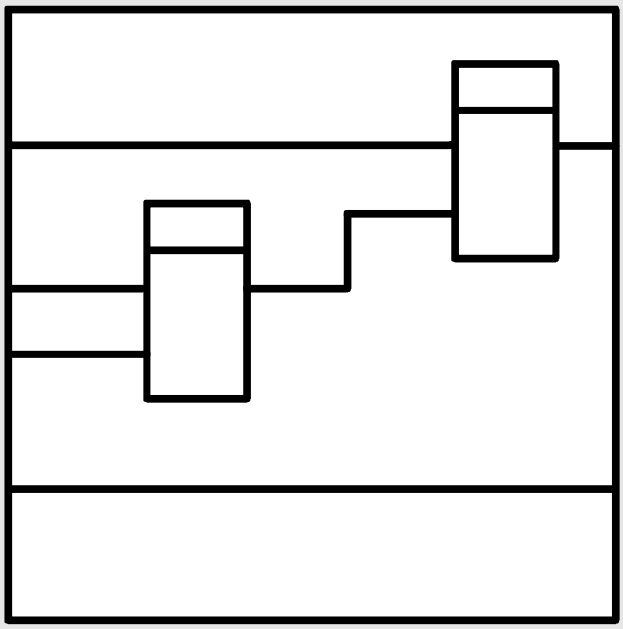
SIMADYN D
Digital Control System

User Manual

Processor module PM16



Edition 05.95

DK-Nr. 221441

User Manual, Processor module PM16

Edition		Edition status
1	Processor module PM16	03.91
2	Processor module PM16	05.95

We have checked the contents of this Manual to ensure that they coincide with the described hardware and software. However, deviations cannot be completely ruled-out, so we cannot guarantee complete conformance. However, the information in this document is regularly checked and the necessary corrections included in subsequent editions. We are thankful for any recommendations or suggestions.

Contents

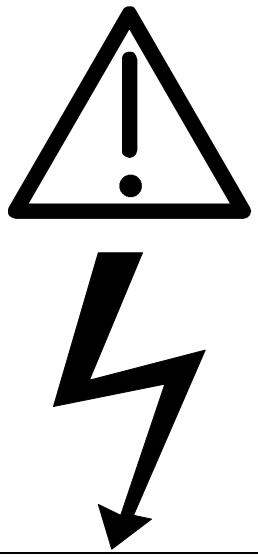
N O T E !

The information in this Manual does 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, please contact your local Siemens office.

Further, the contents of this Manual shall not become a part of or modify any prior or existing agreement, committment or relationship. The sales contract contains the entire obligation of Siemens. The warranty contained in the contract between the parties is the sole warranty of Siemens. Any statements contained herein do not create new warranties nor modify the existing warranty.

Warning information



W A R N I N G !

Electrical equipment has components which are at dangerous voltage levels.

If these instructions are not strictly adhered to, severe bodily injury and material damage can result.

Only appropriately qualified personnel may work on this equipment or in its vicinity.

This personnel must be completely knowledgeable about all the warnings and service measures according to this User Manual.

The successful and safe operation of this equipment is dependent on proper handling, installation, operation and maintenance.

Definitions

* **QUALIFIED PERSONNEL**

For the purpose of this User Manual and product labels, a „Qualified person“ is someone who is familiar with the installation, mounting, start-up and operation of the equipment and the hazards involved. He or she must have the following qualifications:

1. Trained and authorized to energize, de-energize, clear, ground and tag circuits and equipment in accordance with established safety procedures.
2. Trained in the proper care and use of protective equipment in accordance with established safety procedures.
3. Trained in rendering first aid.

* **DANGER**

For the purpose of this User Manual and product labels, „Danger“ indicates death, severe personal injury and/or substantial property damage will result if proper precautions are not taken.

* **WARNING**

For the purpose of this User Manual and product labels, „Warning“ indicates death, severe personal injury or property damage can result if proper precautions are not taken.

* **CAUTION**

For the purpose of this User Manual and product labels, „Caution“ indicates that minor personal injury or material damage can result if proper precautions are not taken.

* **NOTE**

For the purpose of this User Manual, „Note“ indicates information about the product or the respective part of the User Manual which is essential to highlight.

C A U T I O N !

This board contains components which can be destroyed by electrostatic discharge. Prior to touching any electronics board, your body must be electrically discharged. This can be simply done by touching a conductive, grounded object immediately beforehand (e.g. bare metal cabinet components, socket protective conductor contact).

W A R N I N G !

Hazardous voltages are present in this electrical equipment during operation.

Non-observance of the safety instructions can result in severe personal injury or property damage.

It is especially important that the warning information in all of the relevant Operating Instructions are strictly observed.

1. Order Designation:

6DD 1600 - 0AF0 Processor module PM16 with 128K RAM for software versions from 3.0 .

2. Functional Description

The processor module PM16 processes general technological control, calculation and regulation tasks in the SIMADYN D system. These tasks lie above the drive level control and regulation functions (torque shell). The board contains the -CMOS- 16 bit microprocessor 80C186 - 16MHz with corresponding peripherals.

Plug-in program memory modules (MS31, MS3) are used in the mounting location X50 for the board user programs as well as for the system firmware (operating system, supervisor program, function module code, ...). The user programs run on the processor under the SIMADYN D real time operating system. This guarantees interrupt controlled fixed cycle times of ≥ 1ms, dependent upon the configuration.

There are 16 binary input and 16 binary output channels available for the fast exchange of data with the process IO (connector X5).The binary inputs can be declared, via software, as interrupt inputs. At the occurrence of a signal edge at an interrupt input, the processor interrupts the current cyclic processing and runs the function packet process interrupt job PIJ . Connection cables carrying binary signals are connected to interface modules and not directly to the processor module.

The interface modules implement both the mechanical connection terminal and the electrical signal adaptation. The plant signals can be directly connected to these terminals.

Two serial interfaces (connectors X01, X02) are available for communication :

- to a higher level computer
- for data transfers between SIMADYN D systems
- listing outputs to printers
- to the SIMADYN D system peripheral IO
  (operator panel OP1, service unit US1 and programming unit PG 675, 685 or 750)

The seven segment display on the board front panel, indicates a "-" character during the start-up phase and the configured processor number during normal operation. The display flashes with an error code when a fault occurs.

The error codes are described in the processor module handling instructions /1/.

When an error message is displayed, the HEX supervisor can be activated by pressing the S1 key.

A forced board reset (Restart) can be initiated using the twin jack connectors X10 and X11 . The jack connectors must therefore be jumpered by a switch or a shorting plug.

The 50 pin diagnostic connector X4 is available on the board for hardware diagnostics using a logic analyzer or a recorder.

Three watchdogs are installed on each processor board to monitor the hardware and software system states.

The hardware monitor checks:

- Ready signal time-outs during system bus accessing
- Double address decoding errors
- Accessing unused or non-existent addresses
- Collision detection of a DMA access with a system bus access (Detection can be disabled by software)
- System bus fault messages

The software monitor checks:

- Whether the processor is still running a cyclic task.
- Whether the interrupt controller for the serial interface, timer and inputs are fully operational.

A "Non-Maskable Interrupt" (NMI) is generated when the supervisor detects a fault. The processor attempts to resolve the problem and resume cyclic operation. If the fault is caused by the processor itself, then the processor switches to 'inactive', the red dot on the seven segment display is switched on and the bus signal "system error" is activated.

3. Board Design

- Connectors for local and communication busses.
  - CPU 80C186 - 16 MHz
  - RAM 128 K Byte
    Battery buffered by the power supply (PS)
  - Connector terminal for the program memory sub-modules MS3/31/4/45
  - 2 serial interfaces
    selection of V24(RS232), 20mA(TTY), RS485
  - 16 binary inputs
    no galvanic isolation, used as interrupt controlled inputs
  - 16 binary outputs
    no galvanic isolation
    maximum of 30V / 50mA
  - Real time clock
    resolution 10 ms; battery buffered by the PS
  - 7 segment display for the configured processor number
    or error display
  - Board identification

- Hardware and software monitoring by watchdogs

- Test connector for a logic analyzer or recorder

4. Application Notes

The processor module PM16 can be installed in both the large racks such as SR1 and SR5 with local and communication busses and the small racks such as SR2 and SR4 with local bus. It occupies two standard slots in the racks.

The rack must either be installed with the bus terminator or a memory coupling board.

The board can be installed on any rack slot with "slot number coding", that contains the SIMADYN D system bus interface. Whereby, it should be noted that the left-aligned slot must be installed with a local bus master (processor module). If this is not adhered to, then the local peripheral boards will not be supplied with the 8MHz clock. Daisy chain jumpers must be installed on empty slots for multi-processor configurations.

The board must be fixed to the rack by screws (even during commissioning) to ensure correct functioning.

If the board is connected to an adapter, then the frame must be shorted to the rack housing by a short conductor.

The board may not be pulled or installed under power.

When the serial interfaces X01 and X02 are used, then thick film interface modules (hybrid modules) must be installed. The following hybrid modules are currently available:

SS1 : 20 mA (TTY)
SS2 : V.24 (RS 232)
SS3 : (RS 485)

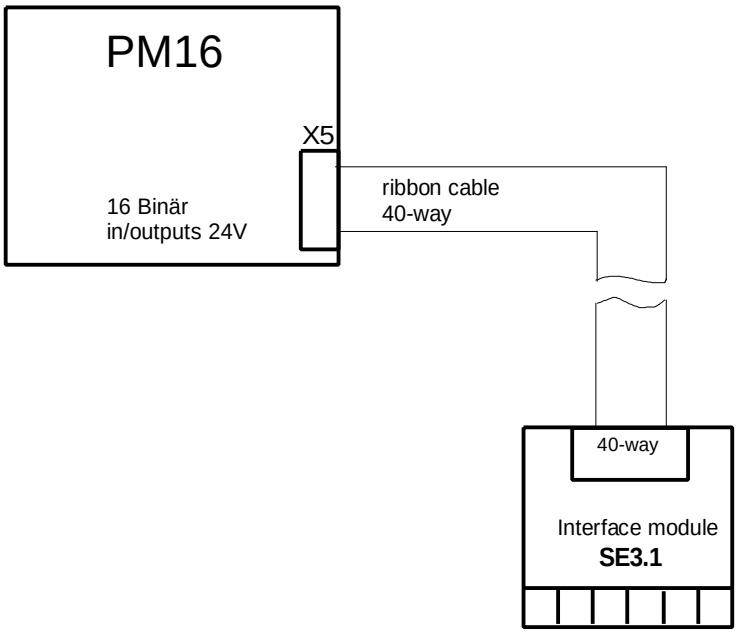
The hybrid module for the serial interface X01 is to be installed on connector X51 (U1) and on connector X52 (U2, see printed diagram) for the interface X02 .

ATTENTION: CHECK INSTALLATION LOCATION CAREFULLY!

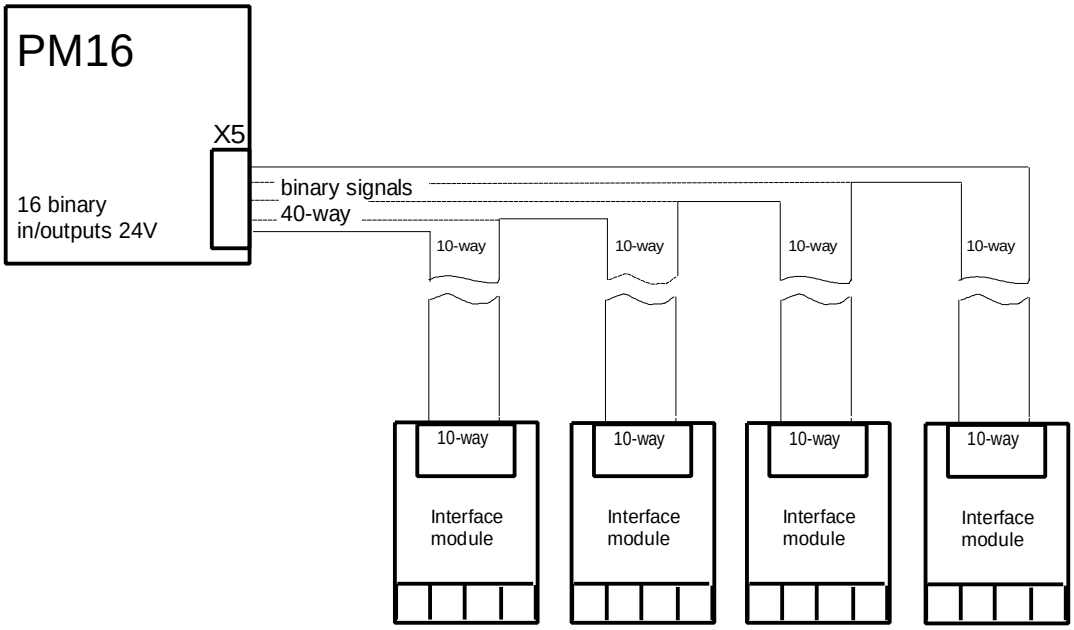
The binary inputs and outputs are connected via interface modules, which are fixed to a terminal rail. The connection from the board connector X5 to the interface modules is implemented with ribbon cable.

The following connection configurations are possible:

a) All 16 binary inputs and outputs are brought from the PM16 connector X5 to the interface module SE3.1 (24V no galvanic isolation) via a 40 pin ribbon cable.The external connection to the plant are implemented there (screw terminals).



b) The 16 binary inputs and outputs are distributed to 4 different interface modules. A ribbon cable is therefore connected to the PM16 board connector X5 with split connectors at the other end (4x10 pin) which are then brought out to the interface modules. It is then possible to connect e.g. 8 inputs or outputs with galvanic isolation and 8 without galvanic isolation. The reference voltage of M24/screen may be selected via the DIP-FIX switch S2 for the binary input signals. The default setting is the reference voltage for M24 (s. 2GE 465 600 9005.01 AO).



Additional PM16 components:

a) Serial Interfaces

- Hybrid interface SS1 (20 mA)	6DD 1688-1AA0
- Hybrid interface SS2 (V24)	6DD 1688-1AB0
- Cable PM-SE12.1 : SC30.1 20 mA/ 2 m	6DD 1684-0DA1
- Cable PM-AS 512 : SC22.1 20 mA/ 10 m	6DD 1684-0CC1
- Cable PM-PG 675 : SC32 20 mA/ 10 m	6DD 1684-0DC0
- Cable PM-printer : SC34 20 mA/ 10 m	6DD 1684-0DE0
- Set of parts 25pin Cannon connector: SM3.1	6DD 1680-0AD0
- Hybrid interface SS3 (RS485)	6DD 1688-1AC0
- Cable : SC27 RS485/ 2,1 m	6DD 1684-0CH0
- SE 47.1 Bus connector module	6DD 1681-0EH0

b) Binary input cable

- 40pin	2,0 m SC18	6DD 1684-0BJ0
- 40pin --> 4+10pin	2,0 m SC13	6DD 1684-0BD0

c) Interface module

- SE3.1 — 6DD 1681-0AD0
  16 Binary inputs and outputs, no galvanic isolation

- SE4.1 — 6DD 1681-0AE1
  8 Binary inputs and outputs, no galvanic isolation

- SE5.3 — 6DD 1681-0AF3
  8 Binary inputs maximum 220V galvanic isolation

- SE6.1 — 6DD 1681-0AG1
  8 Binary outputs maximum 220V galvanic isolation

- SE37 — 6DD 1681-0DH0
  8 Binary outputs 24V galvanic isolation

- SE41.1 — 6DD 1681-0EB1
  8 Binary inputs 48V galvanic isolation
  6DD 1681-0EB2
  8 Binary inputs 24V galvanic isolation

5. Technical Specifications

5.1. General Data

INSULATION GROUP	A FROM VDE 011 PARAGRAPH 13 GROUP 2 AT 24V-,15V,5V-
AMBIENT TEMPERATURE	0 TO 55 DEG. C WITH FORCED VENTILATION
STORAGE TEMPERATURE	-40 TO +70 DEG. C
HUMIDITY CLASS	F ACCORDING TO DIN 40050
ALTITUDE RATING	S ACCORDING TO DIN 40040
MECHANICAL STRESS	INSTALL IN FIXED EQUIPMENT, SENSITIVE TO VIBRATIONS
PACKAGING SYSTEM	ES 902 C
DIMENSIONS	233,4 * 220 MM
BOARD WIDTH	2 2/3 SEP = 2EB = 40.28 MM
WEIGHT	0,7 KG

5.2. Electrical data

5.2.1. Power supply

		cross-connection protection	Fuse protection
VOLTAGE	+ 5 V	no	no
VOLTAGE	+ 15 V	no	no
VOLTAGE	- 15 V	no	no
VOLTAGE	VCC	no	no
VOLTAGE	+ 3,4 V EXT	yes	no

		DES	MIN	TYPICAL	MAX	UNIT
VOLTAGE	(+ 5 V)	+ 5 V	+ 4,75		+ 5,25	V
VOLTAGE	(+ 15 V)	+ 15 V	+ 14,40		+ 15,60	V
VOLTAGE	(- 15 V)	- 15 V	- 14,40		- 15,60	V
VOLTAGE	VCC	VCC	+ 2,20		+ 5,25	V
VOLTAGE	(+ 3,4 V EXT)	+ 3,4 V EXT	+ 2,20		+ 5,90	V
HARMONICS	(+ 5 V)				0,10	Vpp
HARMONICS	(+ 15 V)				0,15	Vpp
HARMONICS	(- 15 V)				0,15	Vpp
HARMONICS	VCC				---	Vpp
HARMONICS	(+ 3,4 V)				---	Vpp
CURRENT	(+ 5 V) without modules				1,30	A
CURRENT	(+ 5 V) without module				1,40	A
CURRENT	(+ 15 V)				0,05	A
CURRENT	(- 15 V)				0,05	A
CURRENT	VCC (buffered)				0,80	mA
CURRENT	(+ 3,4 V) (buffered)				1,15	mA
POWER LOSS	(+ 5 V) without modules				7,00	VA
POWER LOSS	(+ 15 V)				0,78	VA
POWER LOSS	(- 15 V)				0,78	VA
	VCC				4,00	mVA
	(+ 3,4 V)				3,90	mVA

5.2.2. Binary inputs

NUMBER	16 NO GALVANIC ISOLATION
INPUT VOLTAGE	+ 24 V RATED VALUE
INPUT VOLTAGE	
FOR 0 SIGNAL	-1 V TO + 6 V ;OR BINARY INPUT OPEN
FOR 1 SIGNAL	+ 13 V TO + 33V
INPUT CURRENT	
FOR 1 SIGNAL	TYP. 3 MA
RESPONSE TIME	220 uS with hybrid capacitor
RESPONSE TIME	20 uS without hybrid capacitor / Standard design

5.2.3. Binary outputs

NUMBER	16 NO GALVANIC ISOLATION!
POWER SUPPLY	P24 EXTERNAL SUPPLY
-RATED VALUE	24 V -
-HARMONICS	3.6 V -
-PERM. RANGE	+ 20 TO +30 V INCL. HARMONICS
-TEMPORARILY	+ 35 V SMALLER 0,5 SEC.
CURRENT COMSUMP.	P24 MAX. 900mA
OUTPUT CURRENT FOR 1 SIGNAL	
-RATED VALUE	50 MA
-PERM. RANGE	0.2 MA TO 50 MA
SHORT CIRCUIT PROTECT ELECTRONIC	
INDUCTIVE LIMITATION	
TRIP VOLTAGE	AT V CC + 1 V
TOTAL LOADING	80 % FOR 50 DEG C ALL OUTPUTS 50 MA
RESIDUAL CURRENT	20 uA FOR O SIGNAL
SIGNAL LEVEL	
-FOR 0 SIGNAL	MAX. 3 V
-FOR 1 SIGNAL	MIN. SUPPLY - 2.5 V
SWITCHING DELAY	15 uS

5.2.4. Serial Interfaces

NUMBER	2
DATA RATE	MAX. 19.2 KBd / SS1 (20 mA) / SS2 (V24) MAX. 1.0 MBD / SS3 (RS485)

6. Pin allocation of the PM16

6.1. Allocation of the serial interfaces X01, X02

PIN	V24		20 MA (TTY)	
1	FRAME GROUND		FRAME GROUND	
2	TRANSMIT DATA OUT	T*D	---	
3	RECEIVE DATA IN	R*D	---	
4	REQUEST TO SEND OUT	*RTS	---	
5	CLEAR TO SEND	*CTS	---	
6	DATA SET READY IN		---	
7	GROUND		---	
8	DATA CARRIER DETECT IN	*DCD	---	
9	GROUND		GROUND	
10	---		CURRENT LOOP + TRANSMIT	+T*D
11	+ 15 V		+ 15 V	
12	---		20 MA SOURCE 1	
13	---		CURRENT LOOP + RECEIVE	+R*D
14	---		CURRENT LOOP - RECEIVE	-R*D
15	RECEIVE/TRANSMIT CLOCK	*RT*C	---	
16	---		20 MA SOURCE 2	
17	RECEIVE/TRANSMIT CLOCK		---	
18	GROUND		GROUND	
19	---		CURRENT LOOP - TRANSMIT	-T*D
20	DATA TERMINAL READY OUT		---	
21	---		20 MA DRAIN 1	
22	+ 5 V		+ 5 V	
23	+ 5 V		+ 5 V	
24	TRANSMIT RECEIVE CLOCK	*TR*C	20 MA DRAIN 2	
25	- 15 V		- 15 V	

PIN	RS485	
1	FRAME GROUND	
2	REQUEST TO SEND	+OUT 1,D
3	TRANSMIT/RECEIVE CLOCK	+IN 2,R
4	---	
5	TRANSMIT DATA OUT	+OUT 2,D
6	RECEIVE/TRANSMIT CLOCK	+IN 3,R
7	DATA CARRIER DETECT	+IN 4,R
8	RECEIVE DATA IN	+IN 1,R
9	GROUND	
10	---	
11	+ 15 V	
12	---	
13	---	
14	REQUEST TO SEND	-OUT 1,D
15	TRANSMIT/RECEIVE CLOCK	-IN 2,R
16	---	
17	TRANSMIT DATA OUT	-OUT 2,D
18	GROUND	
19	RECEIVE/TRANSMIT CLOCK	-IN 3,R
20	DATA CARRIER DETECT	-IN 4,R
21	RECEIVE DATA IN	-IN 1,R
22	+ 5 V	
23	+ 5 V	
24	---	
25	- 15 V	

6.2. Pin allocation of the binary inputs and outputs, Connector X5

Ribbon cable connector

PIN	DES.	CONNECTOR	
1	OUTPUT 1	X5 A	
2	OUTPUT 2	X5 A	
3	OUTPUT 3	X5 A	
4	OUTPUT 4	X5 A	
5	OUTPUT 5	X5 A	
6	OUTPUT 6	X5 A	
7	OUTPUT 7	X5 A	
8	OUTPUT 8	X5 A	
9	P EXTERNAL	X5 A	
10	M EXTERNAL	X5 A	
11	OUTPUT 9	X5 B	
12	OUTPUT 10	X5 B	
13	OUTPUT 11	X5 B	
14	OUTPUT 12	X5 B	
15	OUTPUT 13	X5 B	
16	OUTPUT 14	X5 B	
17	OUTPUT 15	X5 B	
18	OUTPUT 16	X5 B	
19	P EXTERNAL	X5 B	
20	M EXTERNAL	X5 B	
21	INPUT 1	X5 C	pos. INTERRUPT CONTROLLED
22	INPUT 2	X5 C	pos. INTERRUPT CONTROLLED
23	INPUT 3	X5 C	pos. INTERRUPT CONTROLLED
24	INPUT 4	X5 C	pos. INTERRUPT CONTROLLED
25	INPUT 5	X5 C	pos. INTERRUPT CONTROLLED
26	INPUT 6	X5 C	pos. INTERRUPT CONTROLLED
27	INPUT 7	X5 C	pos. INTERRUPT CONTROLLED
28	INPUT 8	X5 C	pos. INTERRUPT CONTROLLED
29	P EXTERNAL		
30	M EXTERNAL		
31	INPUT 9	X5 D	pos. INTERRUPT CONTROLLED
32	INPUT 10	X5 D	pos. INTERRUPT CONTROLLED
33	INPUT 11	X5 D	pos. INTERRUPT CONTROLLED
34	INPUT 12	X5 D	pos. INTERRUPT CONTROLLED
35	INPUT 13	X5 D	pos. INTERRUPT CONTROLLED
36	INPUT 14	X5 D	pos. INTERRUPT CONTROLLED
37	INPUT 15	X5 D	pos. INTERRUPT CONTROLLED
38	INPUT 16	X5 D	pos. INTERRUPT CONTROLLED
39	P EXTERNAL		
40	M EXTERNAL		

7. STRUC L-Mask for the PM16 board Master program

(see Master program description)

STRUC-L MASK

```
      : PM16          ^"processor module 1 standard, L+C-bus^"
PIJ 1N = 0            ^"alarm processing FP^"
SFJ 1N = 0            ^"system error FP^"
PRX 1N = 0            ^"special communication FP receive^"
PJ1 1N = ?            ^"1. permanent processing FP^"
PJ2 1N = 0
PJ3 1N = 0
PJ4 1N = 0
PJ5 1N = 0
PJ6 1N = 0
PJ7 1N = 0
PJ8 1N = 0
PTX 1N = 0             ^"special communication FP transmit^"
ILS IK = 0            ^"L-Bus-Interrupt transmit^"
ICS IK = 0            ^"C-Bus-Interrupt transmit^"
TO  TG = ?            ^"basic sampling time^"
T1  TS = ?            ^"1. s.t.*T0,produced LB- and CB-conn.^"
T2  TS = ?            ^"2. s.t.       ^"          ^"
T3  TS = ?            ^"3. s.t.       ^"          ^"
T4  TS = ?            ^"4. s.t.       ^"          ^"
T5  TS = ?            ^"5. s.t.       ^"          ^"
TY  TX = T?            ^"sampling time of system FP^"
SSM 2C = 0            ^"Length SAVE-area, (n*1+2) kByte^"
ISE 1C = N            ^"Ignore syst. except. (RDYINT) (Y/N) ?^"
CCT 8R = 0            ^"transmitter communication names.Tx^"
CCR 8R = 0            ^"receiver communication names.Tx^"
COP 8R = 0            ^"service communication names.Tx^"
CMS 8N = 0             ^"message system names^"
CTS 8N = 0            ^"comm. transport system names^"
MS  2M = 0            ^"message systems^"
X01 1M = 0            ^"1. serial interface^"
X02 1M = 0            ^"2. serial interface^"
X5C 8K <              ^"binary inp. 1, interrupt ctr.^"
X5D 8K <              ^"binary inp. 2, interrupt ctr.^"
X5A 8K >              ^"binary outputs 1^"
X5B 8K >              ^"binary outputs 2^"
```

The PM16 requires 3 Sub-modules :

- 1 * PROGRAM MEMORY
- 2 * SERIAL INTERFACES

The X5 connector, binary input and output, can be accessed by the following function modules:

```
CONN. SECTION        FUNCTION MODULE

    X5C -|--|- BII8     Binary input (8 Binary valu&es)
    X5D -|  |- BID8     Binary input (8 Binary valu&es, normal mode)
```

```
        |- SBI       Numerical input, Byte

X5A -|--|- BIQ8      Binary output (8 Binary valu&es)
X5B -|  |- BQD8      Binary output (8 Binary valu&es, normal mode)
        |- SBQ       Numerical output, Byte
```

8. Appendix

8.1. Block diagram

Block diagram	3GE.465 600.9005.01 SU

8.2. Scale drawing and connector table

Scale drawing with front panel view and table of the utilized connectors	3GE.465 600.9005.00 MB

8.3. Arrangement drawing

Arrangement drawing	3GE.465 600.9005.02 AO

9. Miscellaneous

10. ECB instructions

Components which can be destroyed by electrostatic discharge (ECB)

Generally, electronic boards should only be touched when absolutely necessary.

The human body must be electrically discharged before touching an electronic board. This can be simply done by touching a conductive, grounded object directly beforehand (e.g. bare metal cubicle components, socket outlet protective conductor contact.

Boards must not come into contact with highly-insulating materials - e.g. plastic foils, insulated desktops, articles of clothing manufactured from man-made fibers.

Boards must only be placed on conductive surfaces.

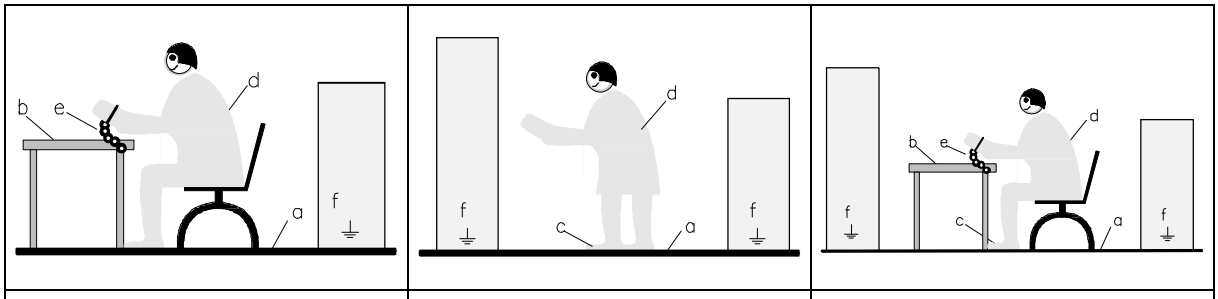
When soldering, the soldering iron tip must be grounded.

Boards and components should only be stored and transported in conductive packaging (e.g. metalized plastic boxes, metal containers).

If the packing material is not conductive, the boards must be wrapped with a conductive packing material, e.g. conductive foam rubber or household aluminum foil.

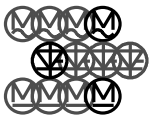
The necessary ECB protective measures are clearly shown in the following diagram.

a = Conductive floor surface
b = ECB table
c = ECB shoes
d = ECB overall
e = ECB chain
f = Cubicle ground connection



Seated	Standing	Standing/sitting

Drives and Standard Products
Motors and Drives Systems Group
Postfach 3269, D-91050 Erlangen



System-Based
Technology