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Digital Axial Position Protection System with PROFIBUS-DP Interface DAPS, DAPS AS, DAPS TS

- **Microcontroller based 3-channel measuring system**
- **PROFIBUS-DP Interface (optional)**
- **High safety level due to password protection at each of the monitors**
- **Up to 6 limit values per channel**
- **Two current outputs per channel, one of them electrically isolated**
- **Analog comparison between the three channels**
- **Redundant supplies for monitors and backplane**
- **Self-test functions for electronic circuits and sensors**
- **Simplified fault detection by display messages in plaintext**
- **Electrical isolation of binary input and output signals**
- **RS 232 Interface for input of parameters**
- **RS 485 interface for data exchange with the host computer**
- **Hot swap of boards during operation**

Application:

The axial-position measuring and protection system **DAPS, DAPS AS** and **DAPS TS** serve the measurement and protection of inadmissible high axial displacements of the turbine shaft.

DAPS systems in combination with safety shut-off valves in power plants are suitable to replace older mechanical position control and protection systems.

Due to the consistent triple channel design, beginning with the signal acquisition up to the evaluation of the measured shaft displacement, the operational safety and also the protection function on a high level can be ensured.

Alarm outputs and error messages are output as potential-free relay outputs and as short-circuit proof binary 24 V outputs.

Beside this the alarm outputs are also available as potential free relay contacts in 2-out-of-3 logic.

The system includes an extended fault detection function. The three sensors are continuously checked on operating within the permitted limits.

Moreover, the channels mutually check and supervise the output signals of each other. If the internal fault detection function detects an error, this will be indicated via the output contacts and shown on the display as plaintext.

By using prefabricated connection cables and screw terminals, the systems may be integrated economically in 19“ cabinets.

epro

System lines of the DAPS system:

For the measurement of shaft displacements and the protection against inadmissible high displacements of the turbine shaft, **epro** offers three different **DAPS** lines.

System DAPS

This system offers a maximum in functionality, it requires the following components:

- 3 x Monitor **MMS 6250**
  (incl. firmware applic. no. 0)
  alternatively
- 3 x Monitor **MMS 6250D (/DP)**
  with display,
  (incl. firmware applic. no. 0)
  Profibus-interface (option)

Additionally:
- 1 x Backplane **MMS 6351/00**
- 1 x 19“ Frame **MMS 6352**
- 6 x Screw terminal **MMS 6361**
- 6 x Cable 0.5 m **MMS 6362**
  alternatively
  Cable 3 m **MMS 6360**
- 1 x Configuration kit **MMS 6950**
- 3 x Blind plate **BLE 008,**
  required for the installation of monitors without display

When using this system line, there are additional relay outputs available as logical combinations of the normal function outputs **OUT1.... OUT6** and of the system supervision Channel Clear.

2 v 3 combination output OUT1
2 v 3 combination output OUT2
2 v 3 combination output OUT3
2 v 3 combination Channel Clear
1 v 3 combination Channel Clear

System DAPS AS

This system offers a special functionality for Alstom applications. It requires the following components:

- 3 x Monitor **MMS 6250 (/DP)**
  (incl. firmware appl. no. 2)
  alternatively
- 3 x Monitor **MMS 6250D (/DP)**
  with display
  (incl. firmware appl. no. 2)
  Profibus-interface (option)

Additionally:
- 1 x Backplane **MMS 6351/10**
- 1 x 19“ Frame **MMS 6352**
- 6 x Screw terminal **MMS 6361**
- 6 x Cable 0.5 m **MMS 6362**
  alternatively
  Cable 3 m **MMS 6360**
- 1 x Configuration kit **MMS 6950**
- 3 x Blind plate **BLE 008,**
  required for the installation of monitors without display

When using this system line, there are additional relay outputs available as logical combinations of the normal function outputs **OUT1.. ..OUT6** and of the system supervision Channel Clear.

2 v 3 combination output OUT2
2 v 3 combination output OUT4
OUT5 (= TRIP + CC) Channel A
OUT5 (= TRIP + CC) Channel B
OUT5 (= TRIP + CC) Channel C

System DAPS TS

This system line serves the replacement of MMG 1211TS shaft position monitors of the AEG-Turloop system.

For the redesign on the new system, the old measuring amplifiers MMG 1211TS have to be removed from the slots and each of them replaced by an **MMS 6250** monitor with an **MMS 6253TS** adapter.

The existing Turloop frame remains in the rack, there is no need to rewire the system.

The following components are required:

- 3 x Monitor **MMS 6250**
  (incl. firmware appl. no. 1)

Additionally:
  3 x Adapter **MMS 6253TS**
- 1 x Configuration kit **MMS 6950**
- 1 x Blind plates **MMS 6354**

The **DAPS TS** system replaces the functions of the old Turloop shaft displacement monitoring system.

For the replacement in the Turloop frame only **DAPS TS** monitors without display and without Profibus may be used.

With the **DAPS TS** system line not all functions of **DAPS** or **DAPS AS** are at disposal.

Module supervision, Sensor supervision

All three **DAPS** system lines offer the same extensive system supervision functions.

Reasons for module disturbances can be read out in detail via the communication interface or are displayed in plain text on the display.

This permits the technicians to recognize the reason for the fault immediately.

During the change from the error to the ok-state and after power-on of the module, all functions of the module are blocked for a delay time of 5 sec.

Depending on the backplane or the installed firmware, the indication of faults or overspeeds is made via function outputs and beside this via relay outputs with 2-out-of-3 combinations of the alarm outputs.

The systems lines **DAPS** and **DAPS AS** offer the following supervision functions:

- Analog comparison

- Gap supervision

- Sensor supervision:
(Short-circuit or interruption of the sensor cable)

- Sensor signal
(Supervision of the signal levels)

- Supply current of the measuring chain

- System supply voltages

- System Watch-Dog
(Supervision of the software)

- Temperature supervision

Technical Data:

Signal input:
Differential input, non-reactive, open-circuit and short-circuit proof
Input voltage range:
0...27.3 V_{DC}
Limit range:
0....30 V_{DC}
Input resistance:
>100 KOhm

Sensor signal output:
Front socket SENS.
decoupled, open circuit and short-circuit proof, non-reactive,
Voltage range: 0....4,1 V
Sensor signal x 0,15
Accuracy: ±1% of full scale

Frequency range: 0....10 Hz
Internal resistance: 10 KΩ
Permissible load: > 1 MΩ

Signal conditioning of characteristic values
Before processing by the processor, the input signals are standardized. The characteristic value is proportional to the axial displacement.

Max. measuring range:
depending on the sensor used e.g. ±1mm with PR 6423/xxx-xxx

Measuring error:
< 1% of the measuring range

Current outputs of characteristic values
Calculation of characteristic values and signal evaluation depend on configured functions.

Current output 1 (I_{out1}):
0/4....20 mA or 20....4/0 mA electrically separated from system ground

Accuracy:
±1% of full scale / 16 bit

Current output 2 (I_{out2}):
not available at DAPS TS
0/4....20 mA / 20....4/0 mA, with reference to system ground, feed back of output signal 0...+10 V for internal analog comparison.

Accuracy:
±1% of full scale / 16 bit

Channel supervision and visualization:
Each monitored and permanently checks the signal of the sensor connected to its input and compares the current outputs of the two other channels with the signal of the own current output continuously. Thus a maximum in safety can be ensured.
Faults are indicated with two green LEDs at the monitor front. An indication of the channel supervision is carried out via electrically isolated voltage outputs.

Output "Channel Clear"
Operating mode open circuit or closed circuit mode freely selectable.
Voltage output
+24 V_{DC} = High state
0 V_{DC} = Low state
Max. current:
25 mA (Current limitation)

Alarm/function outputs:
by configuration, depending on the assigned function. Visualization of the state with a yellow LED for each of the function-/ alarm outputs.
Operating mode open circuit or closed circuit mode freely selectable.
Voltage output
+24 V_{DC} = High state
0 V_{DC} = Low state
Max. current:
25 mA (Current limitation)

Binary outputs:
Altogether six function outputs with separate function and limit setting. The functions of the binary outputs as well as the switching characteristics are defined during configuration. The outputs are designed as 24V voltage outputs.

Voltage range
Binary outputs:
The binary outputs are supplied redundantly from the backplane via terminals DC3, DC4 and DC5 at the analog screw terminals, decoupled via diodes, electrically separated from system ground

Voltage range:
U_{out} „High“ = +18….32 V
U_{out} „Low“ = 0…+3.5 V
I_{out} max = 25 mA

Binary inputs:
electrically separated from system ground, common reference.
Voltage inputs - 24 V
Signal level:
“Low”: 0....+3 V
“High”: +13....+32 V
Input resistance: 6.8 kOhm

- external blocking:
To disable the function-/ alarm outputs, e.g. for service and maintenance works etc.

- Reset Latch:
To reset the latched function and alarm outputs.

- Test1 enable / Test2 enable:
Test values for testing the monitoring functions with internally simulated test values. The test-values replace the measuring values.

- Enable Test value:
To enable the test values Test1 / Test2.

Relay outputs DAPS AS
Backplane MMS 6351/10
5 relays, function outputs and channel clear
- 2 out of 3 OUT2
- 2 out of 3 OUT4
- Trip OR CC channel A
- Trip OR CC channel B
- Trip OR CC channel C

U_{max} = 48 V_{DC}, 20 $V_{rms\ AC}$
I_{max} = 4 $A_{AC,\ DC}$
max. cable cross-cut at screw terminals: 1,5 mm^2

Relay outputs DAPS
Backplane MMS 6351/00
6 relays, function outputs and channel clear
- 2 out of 3 OUT1
- 2 out of 3 OUT2
- 2 out of 3 OUT3
- 2 out of 3 Channel Clear
- 1 out of 3 Channel Clear
- one relay reserved for special applications

U_{max} = 48 V_{DC}, 20 $V_{rms\ AC}$
I_{max} = 4 $A_{AC,\ DC}$
max. cable cross-cut at screw terminals: 1,5 mm^2

Technical Data:

Communication interfaces

RS 232:
Front socket to connect a laptop for configuration and visualization purposes

RS 485:
Bus interface for communication with external systems.

No RS 485 bus connection at the Turloop backplane of the **DAPS TS** system.

PROFIBUS–DP (optional)
connection via SUB-D socket at the front plate
Not for DAPS TS

Sensor supply:
Decoupled from the remaining system supply and electrically isolated to the module supply voltage.
Open circuit and short-circuit proof.

Supply voltage: 26,75 V_{DC}
Max. current: 38 mA
Residual ripple: < 20 mV_{SS}
(at supply current 20 mA)

Module supply:
Two redundant inputs, decoupled via diodes, nominal +24V with common ground.
Current consumption:
max. 250 mA per card
(with display)

Permissible voltage range:
18....32 V_{DC}
according to IEC 60654-2

Mechanical design of the printed circuit board:
Euro- Format (100 x 160 mm)
according to DIN 41 494
Width:
with display 14 TE
(approx. 71 mm)
without display 6 TE
(approx. 30 mm)
Connector:
DIN 41 612, design F 48 M

Dimension of total system:
DAPS, DAPS AS, DAPS TS
42 TE (approx. 213 mm)

Programmable measuring parameters:

- Measuring range
- Analog difference
- Warning and alarm limits
- Operating mode of outputs
- Alarm functions
- Test value 1
- Test value 2
- Hysteresis
- Analog comparison
- Channel identification by means of KKS numbers or freely selectable designations
- Current outputs
- Current calibration
- Current suppression
- Current smoothing
- Gap limit
- Channel Clear limits
- Linearization
- Sensor current supervision
- Limit downscaling
- Response delay for alarms

Function outputs, Alarm outputs:

DAPS modules **MMS 6250** provides altogether 6 function outputs. These function outputs may be used as alarm outputs as well as for indications of individual module or error conditions.

The following functions may be assigned to the function outputs:

- off
- GW
- GW + Latch
- Sensor fault
- Gap error
- Test 1
- Test 2
- Analog error
- Ch. Clear 1

Module supervision:

The internal module supervision comprises the following functions:

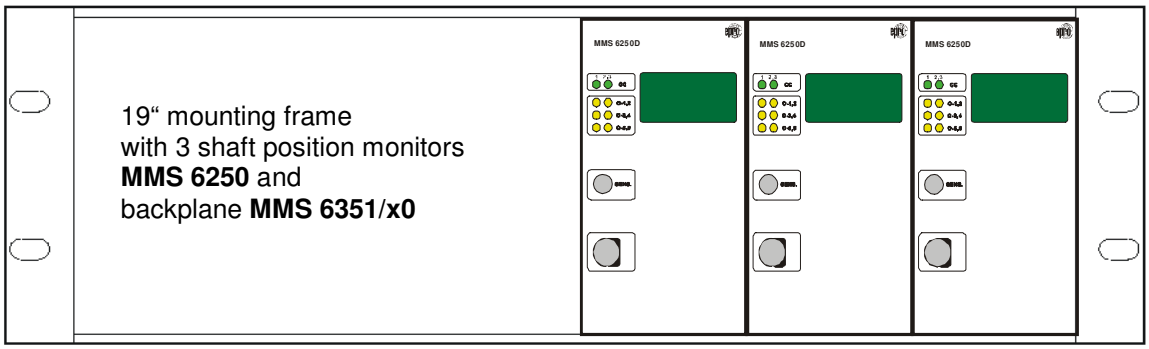
- Transducer signal within a predefined good range
- Wiring between sensor and module (interruption, short-circuit of sensor supply)
- System supply voltage within predefined limits
- Supply current of the measuring chain within a predefined good range
- Gap voltage (initial distance between sensor and measuring target) within a predefined good range
- System watch-dog, check of software and processor

During the change from the error to the ok-state and after power-on of the module, all functions of the module are blocked for a delay time of 5s.
Reasons for module disturbances can be read out in detail via the communication interface or, at modules with display, in plain text on the display.
This permits the technicians to remove the reason for the fault immediately.

Components of the DAPS system:

Eddy current sensors
PR 642x

Signal converters
CON 0x1

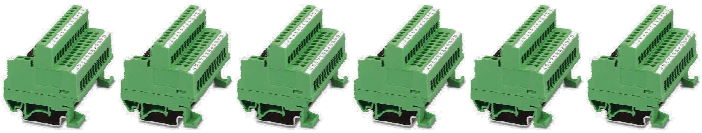


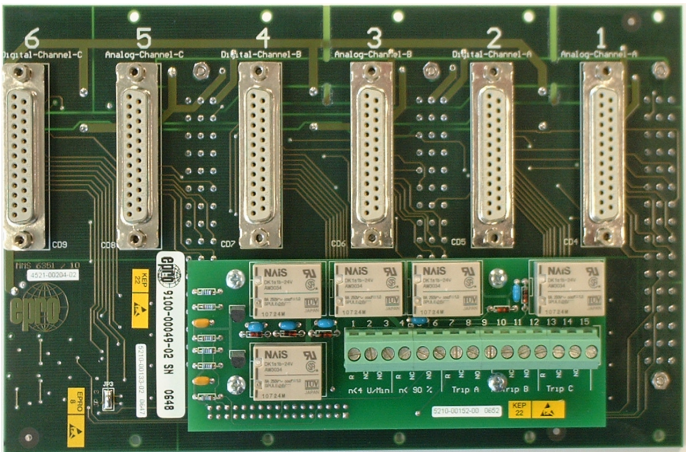
19“ mounting frame
with 3 shaft position monitors
MMS 6250 and
backplane **MMS 6351/x0**

25-pole connection cable

0.5 m length – **MMS 6362**
or
3 m length – **MMS 6360**

Screw terminals **MMS 6361**
to connect
input / output signals and
supply voltages

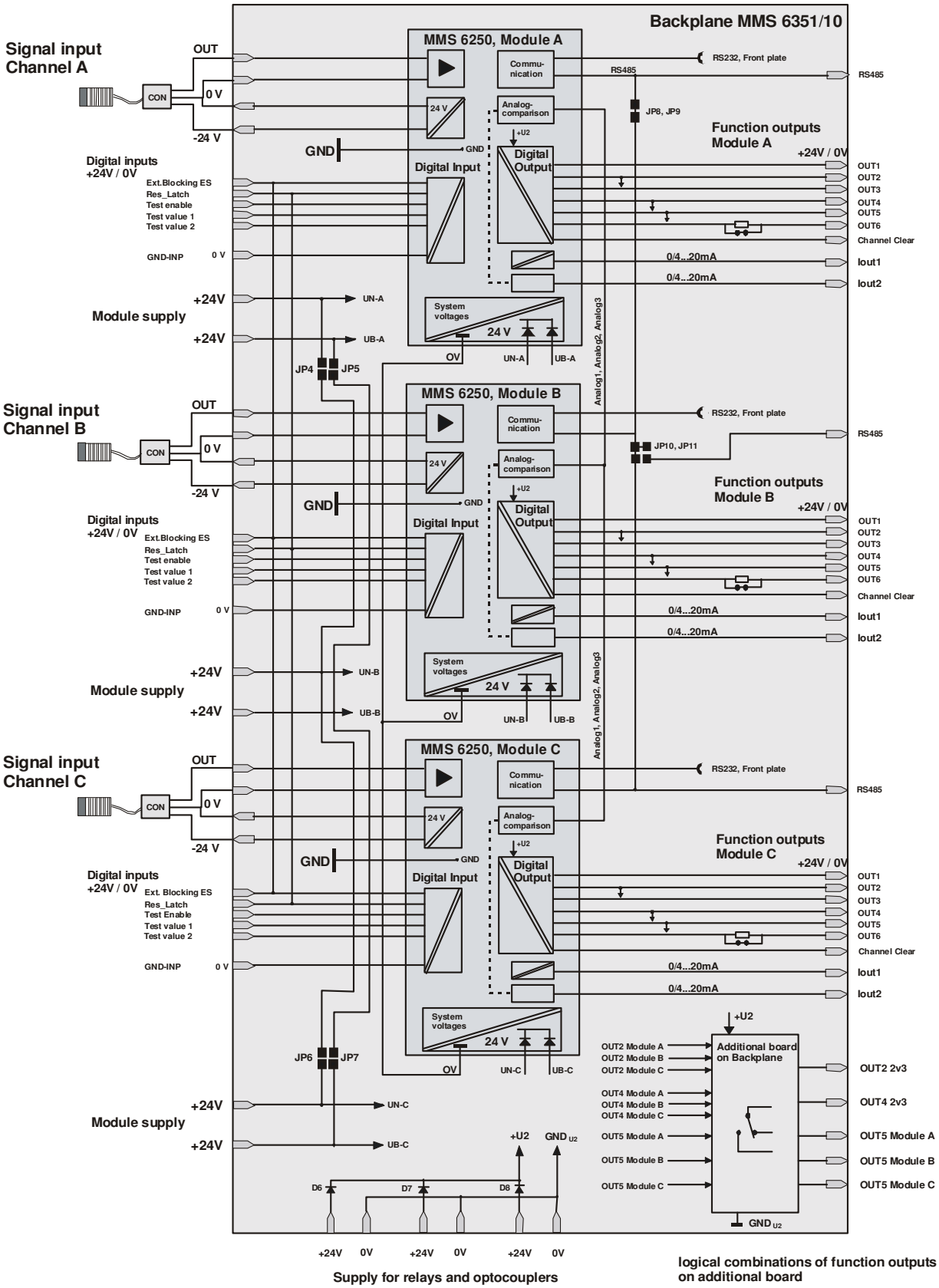




Backplane
MMS 6351/00 for system **DAPS** and
MMS 6351/10 for system **DAPS AS**

with relay contacts on additional board
for 2-out-of-3 combination of
alarms and fault indications

Function diagram DAPS AS with Backplane MMS 6351/10



Display- and operating elements at the module front:

One non-reactive output
SENS (SMB socket):
Sensor signal, unfiltered, buffered, open circuit and short circuit proof.

Range: 0....4,1 V
Load resistance: ≥10 kOhm
Internal resistance: 10 kOhm

MMS 6250D/DP
8-digit alphanumerical LED-matrix, green

6 yellow LEDs:
One LED for each of the function- /limit values

2 green LEDs:
LED 1
Supervision of this channel

LED 2,3
Indication of the state of the two adjacent channels.
If one of these channels fails (analog comparison), it will be indicated via this LED.

1 Mini DIN diode socket:
RS232 interface for connection of a computer for configuration and visualization purposes.

1 SUB-D socket (9-pole)
For connection of the Profibus DP system cable

Handle:
To pull out and insert the module and for labelling purposes.

Power supply of the monitors:

Redundant supply via two supply inputs, decoupled via diodes.

Supply voltage:
+18....24....32 V_{dc} according to IEC 60654-2

Current consumption:
max. approx. 250 mA per card (approx. 250 mA per card, with display and Profibus).

Power consumption of the DAPS system
max. 20 W (840 mA / 24 V)

Other supply voltages can be realized with additional system power supplies.

Environmental conditions:

Protection class:
Module: IP 00 according to DIN 40050
Front plate: IP21 according to DIN 40050

Climatic conditions:
according to DIN 40040 class KTF
Operating temperature range: 0....+55°C max. +65°C

Reference temperature: +23°C

Temperature range for storage and transport:
-40....+70°C

Permissible relative humidity:
5....95%, non condensing

Permissible vibration:
according to IEC- 68-2 part 6

Vibration amplitude:
0.15 mm in range 10...55 Hz

Vibration acceleration:
19.6 m/s^2 in range 55....150Hz

Permissible shock:
according to IEC- 68-2 part 29
peak value of acceleration: 98 m/s^2
nominal shock duration: 16 ms

EMC resistance:
according to EN 50081-1/EN 50082-2

Requirements on configuration PC:

Configuration of **DAPS** modules is made via the RS 232 interface on the front plate of the module or via the RS 485 bus, by means of a computer with the following minimum specifications:

Processor:
Pentium II, 266 MHz or better

Interfaces:
One free RS 232 interface

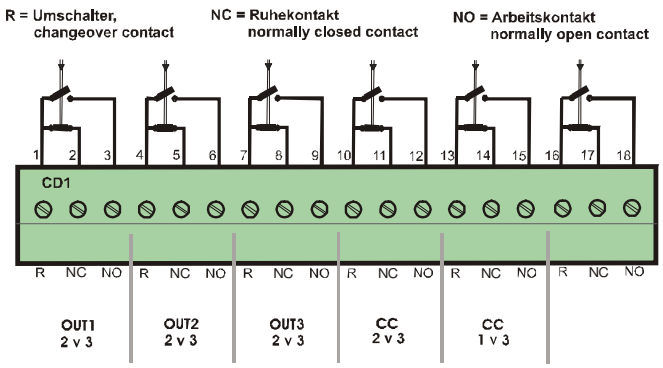
Capacity of hard disk:
min. 150 MB

Required working memory:
min. 500 MB (according to the requirements of the operating system)

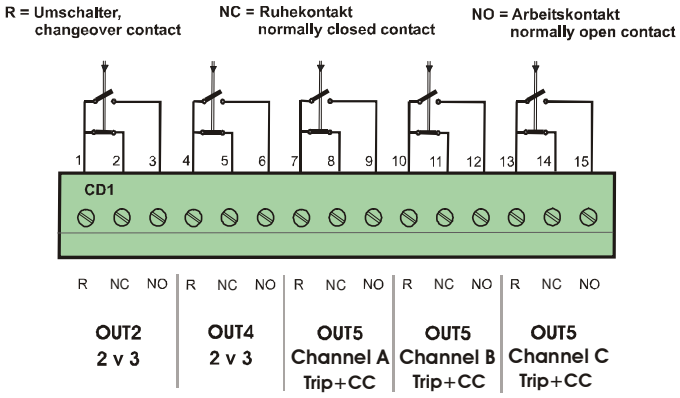
Operating system:
Windows® 2000 or XP

Additional board on backplane MMS 6351/x0 :

Additional board on backplane MMS 6351/00 for the DAPS system
2 out of 3 combinations of the function outputs



Additional board on backplane MMS 6351/10 for the DAPS AS system
2 out of 3 combinations of the function outputs.



Order numbers:

MMS 6250	Shaft displacement monitor	**9100 – 00057**
MMS 6250/D	Shaft displacement monitor with display	**9100 – 00056**
MMS 6250D/DP	Shaft displacement monitor with display and Profibus DP	**9100 – 00084**
MMS 6351/00	Backplane for System **DAPS**	**9100 – 00047**
MMS 6351/10	Backplane for System **DAPS AS**	**9100 – 00049**
MMS 6352	19“ " mounting frame	**9100 – 00053**
MMS 6360	Cable 25 pole SUB D 3 m	**9510 – 00006**
MMS 6362	Cable 25 pole SUB D 0,5 m	**9510 – 00015**
MMS 6363	Profibus cable 4 m	**9510 – 00024**
MMS 6361	Screw terminal 25 pol. SUB D	**9100 – 00052**
MMS 6950	Configuration kit	**9510 – 00005**
MMS 6354	Set of blind plates	**9501 – 00005**
BLE 008	Blind plate 8 TE	**9501 – 00003**

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