Power modules

DN150

DN750

DN1100

DN1850

Translation from German manual

Revisions

Version	Description
12.2008	First Version
09.2010	English Translation
05.2014	Description of the external enabling function Maximum load adapted for interfaces Warranty conditions adapted to current warranty sheet Chapter 5.5 supplemented (Customer-specific configuration) Additions to the analogue output 0 …1DC 0V Additions to the process monitoring level 1 / Chapter 6.5.3
05.2014	New interface module
08.2015	General revision manual Safety Instructions, Intended use, Installation and Commissioning, Operation, Demagnetization, Maintenance, Troubleshooting, Specifications
10.2015	Troubleshooting with Fault
03.2016	Fault at Overtemperature
05.2016	Prefusing, RCCB, ELCB, leakage compensation
08.2017	Junction Box incl. lamp
09.2017	Description STO
07.2018	Additions Residual risk and decommissioning
08.2018	Revision
09.2019	Fieldbus coupler
08.2021	Fieldbus coupler adjustments

General Information

- This manual contains information for safe operation of the machine/machine components
- Read manual of all machine components
- Respect accident prevention regulations
- Respect local regulations
- This manual is a translation of the German original
- In case of questions regarding Installation, commissioning, operation or intended use contact Maurer Magnetic. Contact information on the last page

Liability

Liability is restricted to the intended use. Any other liability is explicitly excluded.

Improper installation, operation, maintenance or use of the machine can lead to body injury and property damage. Maurer Magnetic AG cannot be held liable for losses, consequential damages or cost resulting from or linked with improper installation, operation, maintenance or use.

Table of contents

1 Safety instructions

1.1 Symbols

Indicates situations with risk for body injury and property damage by electromagnetic radiation.

Indicates situations with risks by high electric voltages.

Indicates situations with risk of burns.

Indicates situations that demand special attention.

Indicates danger for persons with a cardiac pacemaker.

1.2 Information on restrictive risks

Persons with cardiac pacemaker must not use the device.

Operate device only in premises with limited access!

Modification, repairs and opening of the device only by skilled personell.

- Wait 10 minutes for capacitor discharge before opening

The supply line to the power module up to the main switch always carries voltage.

High voltages can lead to lethal electric shock and burns.
Opening of the device only by skilled personell.

- No physical contact to energized parts

Modification of the machine leads to loss of waranty.

- Modification can lead to body injury and property damage
- Modification of the parametrisation can lead to overheating and shutdown
- Approval of modification only by Maurer Magnetic AG in writing

1.3 Notes on restrictive risks

Endangerment				Result or protection target	Measures
Life phase		Endangerment	Causes		
1.	1. Transport, Assembly, Installation				
1.1	Transporting / Lifting the machine	Squeezing/Pushing	Gravity	During pick-up / transport, the centre of gravity of the machine could be ignored, so that the machine falls over / down. There is a risk of crushing body parts when setting down.	Specify weight; the load capacity of the conveyor vehicle must be able to lift the weight of the system, Secure the system on the conveyor vehicle against slipping, wear safety shoes
1.2	Installation and orientate	Squeezing/Pushing	Gravity	Ensure that the ground is stable, otherwise tipping is possible.	Specify weight and dimensions
1.3	Up-, and unload with the conveyor vehicles	Squeezing/Pushing	Movable Elements	Prevent moving elements (e.g. doors) on the machine from damaging persons	Secure movable elements against unintentional swivelling or slipping
2.	Commissioning				
2.1	Connecting the electrical system	Electric shock	Contact with voltage charged parts	Incorrect connection could cause machine parts to carry voltage	Only qualified personnel may connect the machine
3.	Operation				
3.1	Persons in the coil area	Electromagnetic radiation	Illegal exposure to electromagnetic radiation	If a person stays in the exposure area it may cause damage to health	Applying warning glue, Perform and include exposure measurement, A shielding chamber is recommended to reduce the exposure radius, The operator of the system is recommended to install a protective housing
3.2	Demagnetizing of components	Moving parts	Attraction of components by the magnetic field of the coil	Components must not be held in the coil by hand, Do not place ferromagnetic parts/tools in the area of the coil	Notes in the manual
3.3	Heating of components	Incineration	Heating	If a ferromagnetic component is exposed to the magnetic field for a long time, the component heats up.	Demagnetization of components using the pulse method
4.	Fault diagnostics, Troubleshooting				
4.1	Trouble-shooting	Electric shock	Contact with voltage charged parts	Incorrect fault diagnostic or measurement may result in contact with voltage charged parts	Only qualified personnel may inspect the machine
5.	Maintenance				
5.1	All maintenance work	Squeezing	Moving parts	Prevent uncontrolled movement	Switch off the main switch before carrying out any work on the machine, Lock main switch and attach warning sign
6.	Decommissioning, Disassemble, disposal				
6.1	Disassemble	See section 1.1			

1.4 Safety electromagnetic fields

See manual coil module

2 Intended use

The demagnetization power modules MM DN150…1850 are products developed and sold by Maurer Magnetic AG. They are intended to be used in combination with compatible demagnetization coil modules such as the MM CT-U, MM SE, MM RE, MM KE, MM VE series or custom-built coil modules.

MM DN modules feature the following functionality:

- A/C source for demagnetization coils
- User interface
- Monitoring of demagnetization coil modules
- External control interface (24VDC)

2.1 Compatibility MM coil modules

Type coil modules	DN150	DN750-1850
MM CT-U	x	x
MM KE	x	-
MM SE	-	x
MM RE	-	x
MM VE-2/4	-	x
custom-built coil	x	x

Table 1: compatible coil modules

3 Device characteristics

The power modules MM DN are separated into two classes. Housing, interface and available options differ between the classes but are identical within the respective class.

- MM DN150
- MM DN750…1850

Following devices are available. The addition „-xx“ indicates the installed capacity.

- MM DN150-xx
- MM DN750-xx
- MM DN1100-xx
- MM DN1850-xx

DN type power modules features:

- CFT – Constant Field Technology
- FMT – Field Multiplicator Technology

3.1 Scope of delivery

- Power module
- Key for enclosure
- Documentation (printed and digital)
- Fixed base (optional)
- Power cable (only DN150)
- Additional options according to order scope

3.2 MM DN150

3.2.1 Controls

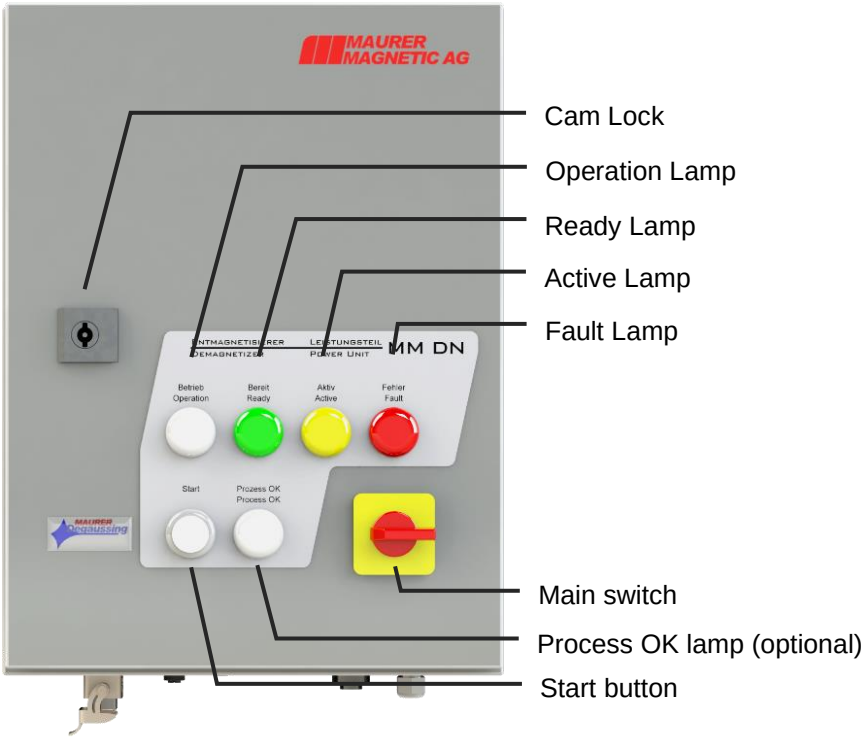

Figure 1: Controls DN150

3.2.2 Connectors

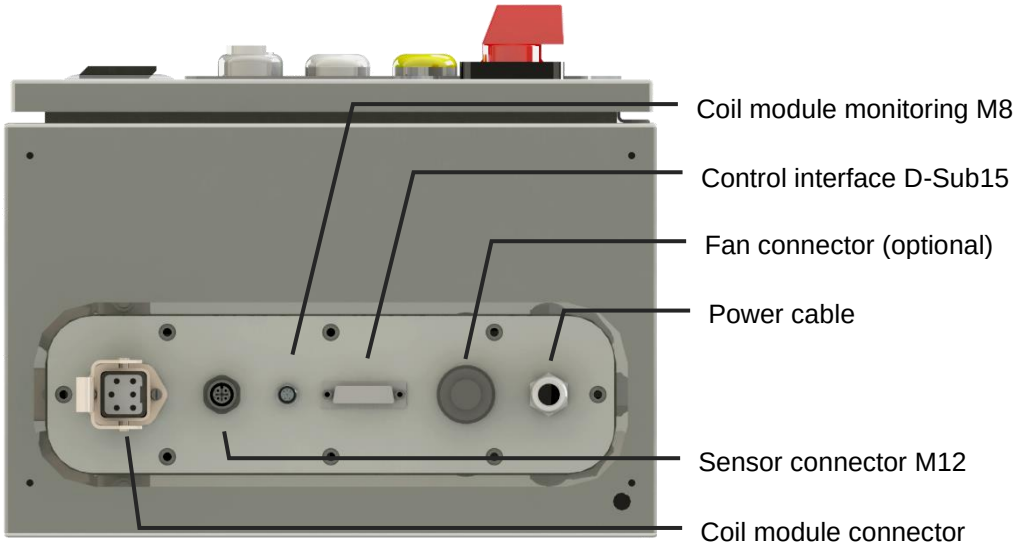

Figure 2: Connectors DN150

3.3 MM DN750…DN1850

3.3.1 Controls

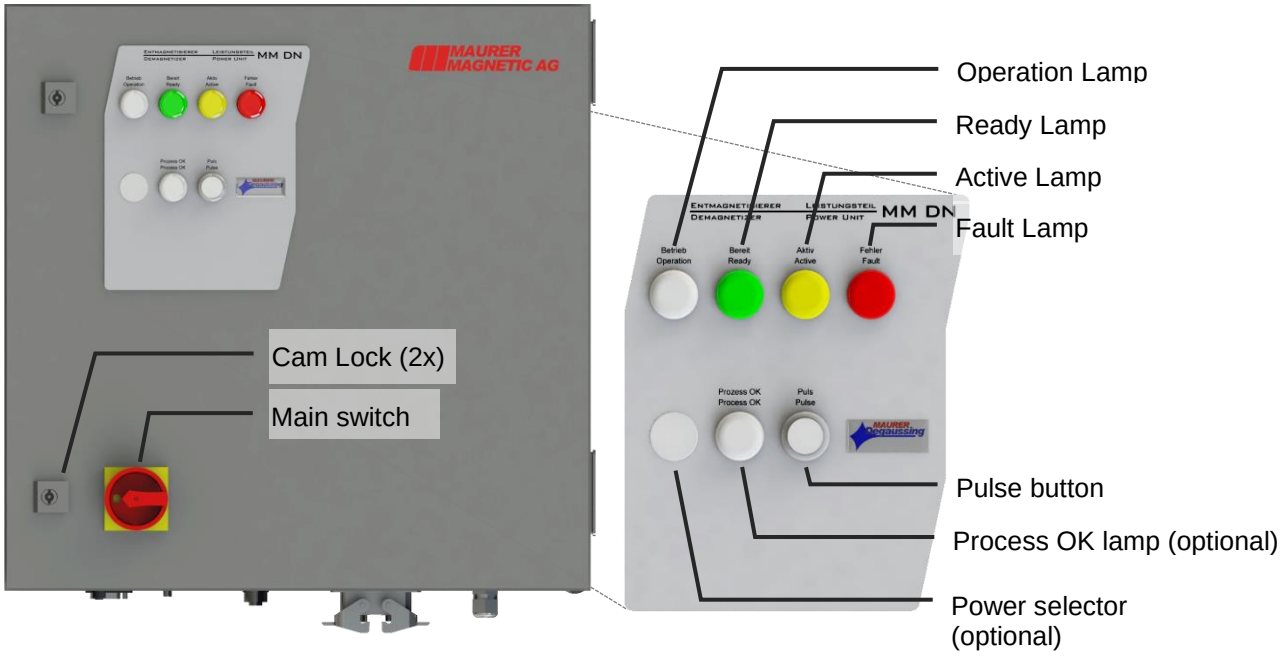

Figure 3: Controls DN750-1850

3.3.2 Connectors

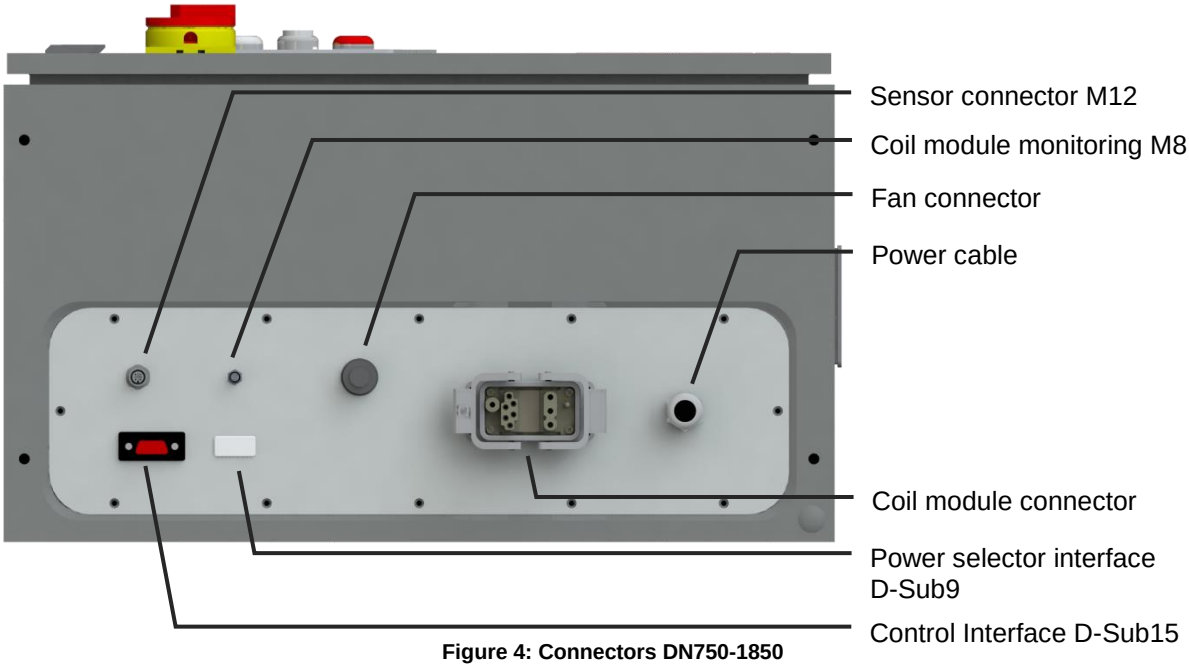

Figure 4: Connectors DN750-1850

4 Installation

Mount device on and flat ground, stable and flat surface.

- Ensure safe operation of device at all times
- Operate power module only upright. **Do not operate in horizontal position**.

Connection and disconnection of the coil module only with main switch off.

Installation and commissioning of the device only by skilled personell.

- Connect only to power source with correctly installed protection conductor
- Connect with regard to local regulations

Improper connection can damage the machine.

- Installation with off-state power source
- Installation with main switch off

Interface signals maximal current load 100mA
D-Sub15 PIN14/15: 0...10 VDC Output maximal current load 1 mA

Do not connect D-Sub interface with computer interface verbinden. Pc and power module may be damaged.

4.1 Transport

Do not lift components of more than 25 kg by hand.

Do not lift coils mounted in shielding chambers on the shielding chamber.

- Lift with support from below

Power module can be lifted and transported by two persons.

4.2 Installation process

- Mounting of coil
- Mounting of power module
- Check fastening torque of power connections
- Connection power supply power module
- Connection *Coil module connector* and *Coil module monitoring M8*
- Connection *Fan connector* (if applicable; MM VE)
- Optional: Connection *D-Sub15 Control Interface*
- Optional: Connection *Power selection interface D-Sub9* (DN750-1850)
- Optional: Connection photo sensor on *Sensor connector M12*

4.3 Mounting

Power module cabinet mounting:

- Placing on fixed base (optional)
- Wall-mount using 4 available mounting eyes

Figure 5: DN with base and wall-mounted

4.1 Connection to grid

4.1.1 DN150

Voltage, current and frequency ranges according to technical specification!

Phase-neutral connection:

For connection phase (L1) and neutral (N) and protective conductor (PE) are required (1P/N/PE).

Phase-phase connection (US) (optional)

For connection two phases (L1/L2) and protective conductor (PE) are required (2P/PE).

Colour code supply connector DN150:

Labelling 1P/N/PE	Colours 1P/N/PE	Labelling 2P/PE	Colours 2P/PE
L1 (phase)	brown	L1 (phase)	black
N (neutral)	blue	L2 (phase)	black
PE (protective conductor)	green/yellow	PE (protective conductor)	green/yellow

Table 2: Colour code supply connector DN150

4.1.2 Power cable (DN150)

The DN150 can be connected to the grid with the provided power cable. If required, replace cable to comply with local regulation.

Delivery worldwide: cable type (16A/250VAC) with safety plug (type E/F, CEE 7/7).

Delivery Switzerland: cable type (13A/250VAC) with safety plug (type J, SEV 1011).

4.1.3 DN DN750…1850

The DN750…1850 is connected as **TN-S Network**. Three phases (L1, L2, L3) and the protective conductor (PE) are required. Neutral and protective conductor laid separately. A terminal connector for the neutral conductor is available but connection is not necessary. Voltage, current and frequency ranges, according to 10.2!

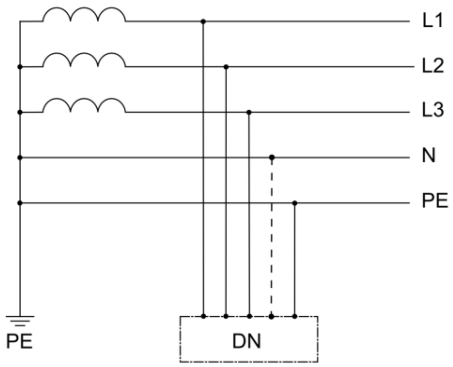

Figure 6: TN-S connection DN750-1850

Colour code supply connector DN750…1850:

Conductor	Colour
L1 (phase)	brown or black
L2 (phase)	black
L3 (phase)	grey or black
N (neutral)	blue
PE (protective conductor)	green-yellow

Table 3: Colour code supply connector DN750…1850

4.2 Prefuse

For maximal and minimal prefuse see electric circuit diagram.

4.2.1 Operator Protection

If a RCCB or ELCB is used it needs to be a *universal current sensitive RCCBs B type*, suitable for protecting frequency inverters.

In case of false triggering of the RCCB, we recommend installation of a leakage compensation (See chapter troubleshooting).

4.3 Coil module connector HAN 3/HAN 10 B

The coil module is connected with a HAN 3 (DN150) or HAN 10 B (DN750-1850) to the power module and latched.

- Voltage range see appendix
- Connector configuration and pin assignment according to circuit diagram

4.4 Fan connector

- Voltage range see appendix
- Connector configuration and pin assignment according to circuit diagram

4.4.1 Fan connector DN150 (optional)

For 230 VAC cooling fan

4.4.2 Fan connector DN750-1850

For 24 VDC cooling fan

4.5 Control signals

Interface signals maximal current load 100mA
D-Sub15 PIN14/15: 0...10 VDC Output maximal current load 1mA.

Do not connect D-Sub interface to a PC verbinden. PC and power module may be damaged.

4.5.1 Coil module monitoring M8

Connection of *Coil module monitoring M8* is required for operation.

The M8 monitoring cable is connected to the *Coil module monitoring M8*. It controls the coil warning light and monitors the coil temperature. Connection is required to operate the machine.

- Connector configuration and pin assignment according to circuit diagram

4.5.2 Sensor connector M12

The *Sensor connector M12* allows the connection of an external pulse trigger (light barrier, capacitive sensor, ...). A suitable light barrier is available at Maurer Magnetic AG.

- Voltage range see appendix
- Connector configuration and pin assignment according to circuit diagram

4.5.3 D-Sub15 Control Interface

The 15 pin *D-Sub15 Control Interface* allows control and monitoring of the machine via 24 VDC signals. Further information

- More information in chapter Operation
- Voltage range see appendix
- Connector configuration and pin assignment according to circuit diagram

4.5.4 D-Sub9 power setting interface (DN750…1850, optional)

The 9 pin *D-Sub9 power setting interface* allows setting power of the power level of the machine via 24 VDC signals.

- More information in chapter Operation
- Voltage range see appendix
- Connector configuration and pin assignment according to circuit diagram

4.6 Modification

Modification of the machine leads to loss of waranty.

- Modification can lead to body injury and property damage
- Modification of the parametrisation can lead to overheating and shutdown
- Agreement of modification only by Maurer Magnetic AG in writing

DN power modules can be automated and integrated in many ways without modification. In case of questions regarding automation and integration contact Maurer Magnetic AG.

5 Commissioning

Indicates danger for persons with a cardiac pacemaker.

Installation and commissioning of the device only by skilled personell.

- Connect only to power source with correctly installed protection conductor
- Connect with regard to local regulations

Mount device on and flat ground, stable and flat surface.

- Ensure safe operation of device at all times
- Operate power module only upright. Do not operate in horizontal position

Connection and disconnection of the coil module only with main switch off.

5.1 Power on

- After correct installation turn main switch on
- White lamp *Operation lamp* is lit
- Green lamp *Ready lamp* is lit

5.2 Trigger demagnetization pulse

- Trigger pulse by pushing *Start button*
- Machine carries out demagnetisation automatically
  - Yellow lamp *Active lamp* is lit during demagnetization pulse
  - Lamp at the coil is lit Yellow
  - After the pulse the *Active lamp* goes out
  - Check fan (if available)
- Pulse duration: ~4…13 second (according to electric circuit diagram)

5.3 Demagnetisation test with intended object

- Measure residual magnetism according to measurement process definitions
- Place object in coil
- Trigger demagnetization pulse
- Remove object after completion (*Active lamp* goes out) of demagnetization pulse
- Measure residual magnetism according to measurement process definitions

5.4 Control via interface (if applicable)

- Readout *Module OK* signal
- Readout *Module Ready* signal
- Trigger pulse
- Readout *Active Ready* signal
- Readout *Analog* Signal
- Readout *Process OK* signal (if applicable)

6 Operation

Indicates danger for persons with a cardiac pacemaker.

Operate device only in enclosed premises accessible only by authorised personell.

Connection and disconnection of the coil module only with main switch off.

- High current flow during demagnetization pulse
- Physical contact to energised parts can be lethal
- Disconnection during pulse results in damaging of the connector
- Wait 10 minutes for capacitor discharge before opening

Interruption of power supply during demagnetization pulse leads to immediate pulse disruption.

- Parts in the vicinity of the coil are magnetised and need to be demagnetised once more
- Frequent interruption accelerates electric wear

Cycle times below specification may lead to overheating of the coil. Pulse triggering is blocked („Ready“ indicator dark, no „Ready“ signal). After cooldown pulse triggering is enabled again.

Danger of burns at power connectors. Poor coupling of conductors can lead to heating of connectors and conductors. Physical contact can lead to burns.

6.1 Operation mode

The machine can be operated manually or automated.

- Manual operation via control panel
- Automated operation via *D-Sub15 Control Interface*

6.1.1 Manual operation

- Place object in coil
- Trigger demagnetization pulse by pushing *Start* button
- Remove object after completion of demagnetization pulse (*Active lamp* goes out) and measure residual magnetism regard to measurement process definitions

6.1.2 Integration in production line

Cycle times below specification may lead to overheating of the coil. Pulse triggering is blocked („Ready indicator dark / no „Ready“ signal, Alarm lamp red / Alarm signal). After cooldown pulse triggering is enabled again.

- Transport of object into coil (conveyor belt, robot, …)
- Object stops inside the coil and does not move during demagnetisation pulse[1]
- Trigger demagnetization pulse via *D-Sub15 Control Interface*
- Further transport of object after completion of demagnetization pulse (*Active* Signal low)

6.2 Controls

6.2.1 Main switch

Only switch off machine during demagnetization pulse in case of an emergency.

The machine is turned on/off with the main switch.

6.2.2 *Start*/*Pulse* button

The white button *Start*/*Pulse* triggers a demagnetization pulse.

6.3 Indicators

Troubleshooting and analysis in chapter troubleshooting.

6.3.1 *Operation lamp*

The *Operation* lamp indicates an active 24VDC power supply.

6.3.2 *Ready* lamp

The *Ready* lamp indicates readiness of the power module to trigger a pulse.

6.3.3 *Fault* lamp

Occurance of a fault during a demagnetization pulse results in immediate pulse disruption. Parts in the vicinity of the coil are magnetised and need to be demagnetised once more.

The *Fault* lamp indicates an error of the inverter.

A flashing *Fault* lamp indicates over temperature of the coil. Operation is no longer possible. After cool-down, pulse triggering is enabled again.

Further Information in Chapter Troubleshooting.

6.3.4 *Active* lamp

The *Active* lamp is lit during a demagnetisation pulse.

A flashing *Active* lamp warns of high coil temperature. Demagnetisation pulse is possible.

[1] The maximum speed of a moving object is 0.1 m/s.

6.3.5 *Process OK* lamp (Process Monitoring Step 1, optional)

Process Monitoring Step 1 monitors the current and the *Process OK* lamp indicates when the target value is reached. It goes out after pulse completion simultaneously with the *Active* lamp.

If the current remains below target value, the *Process OK* lamp remains dark.

6.4 Sensor connection M12

The sensor connection allows a simple automatization without centralised control. A sensor (light barrier, proximity sensor, etc.) is directly connecting to the power module without additional power supply. The sensor is positioned, so that the pulse is triggered when the object is located inside the coil. More information about demagnetization see manual coil module.

6.5 D-Sub15 Control Interface (isolated)

Interface signals maximal current load 100mA.
D-Sub15 PIN14/15: 0...10 VDC Output maximal current load 1mA.

Do not connect D-Sub interface to a PC verbinden. PC and power module may be damaged.

The machine can be fully controlled and monitored via D-Sub15 Control Interface. The interface (except PIN14/15) is electrically isolated and requires external power supply.

6.5.1 Configuration D-Sub15 connector

See appendix for the configuration of the D-Sub15 connector.

6.5.2 PIN2 *Start*

+24VDC at PIN2 for at least 100 ms starts the demagnetization.

For continuous operation +24VDC is fed constantly. Continuous operation requires a special configuration by Maurer Magnetic. See chapter Continuous Demagnetization.

6.5.3 PIN3 *Ready*

+24VDC at PIN3 indicates readiness of the machine.

6.5.4 PIN4 *Fault*

Occurance of a fault during a demagnetization pulse results in immediate pulse disruption. Parts in the vicinity of the coil are magnetised and need to be demagnetised once more.

+24VDC at PIN4 indicates an error of the inverter.

A flashing *Fault* signal (~5Hz) indicates over temperature of the coil. Operation is no longer possible. After cool-down, pulse triggering is enabled again.

6.5.5 PIN5 *Active*

+24VDC is present at PIN5 during a demagnetisation pulse.

A flashing (~5Hz) *Active* signal warns of high coil temperature.

6.5.6 PIN7 *Process OK* (Process Monitoring Step 1, Optional)

Process Monitoring Step 1 monitors the current. +24VDC at PIN7 indicates when the target value is reached. It falls to zero after pulse completion simultaneously with the *Active* signal (PIN5).

If the current remains below target value, PIN7 remains at 0VDC.

6.5.7 PIN10 *External enable signal*

If switch *S1 Enable* is set to *EXT.* on Interface board D-Sub15. +24VDC is required on PIN10 to obtain *Ready* state.

6.5.8 PIN11 *Module Ready*

+24VDC at PIN11 indicates that *Coil module connector* is correctly connected and the coil temperature is ok.

6.5.9 PIN14/15 Analogue *out* (Field strength proportional signal)

PIN14/15 are not electrically isolated.
We recommend using an isolating amplifier (e.g. Phoenix Contact MINI MCR-LS-UI-UI-NC) especially with connection length >5m.

PIN14: 0...+ 10 VDC (Scale: 0…100% of maximum specified field strength)

PIN15: Reference to PIN14

0…+10 VDC at PIN14/15 indicates the current field strength of the machine. 10VDC corresponds to the maximum specified field strength. At 0VDC the field strength is 0.

During a demagnetization pulse the signal rises from 0VDC to +10VDC and declines back to 0VDC. The *analogue out* allows monitoring the machine. The signal exhibits a slight delay.

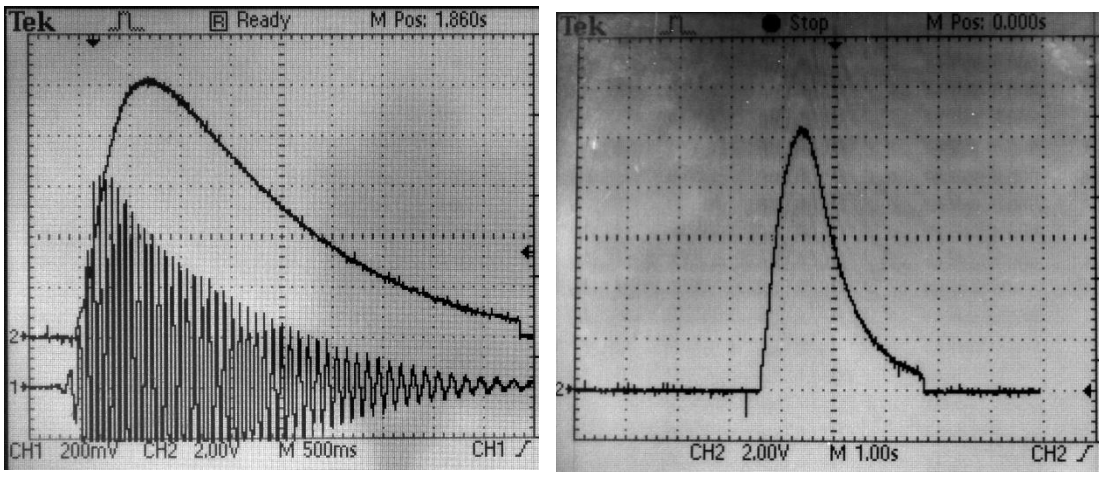

Figure 7 Coil current measurement and analogue signal

6.5.10 Interface board D-Sub15

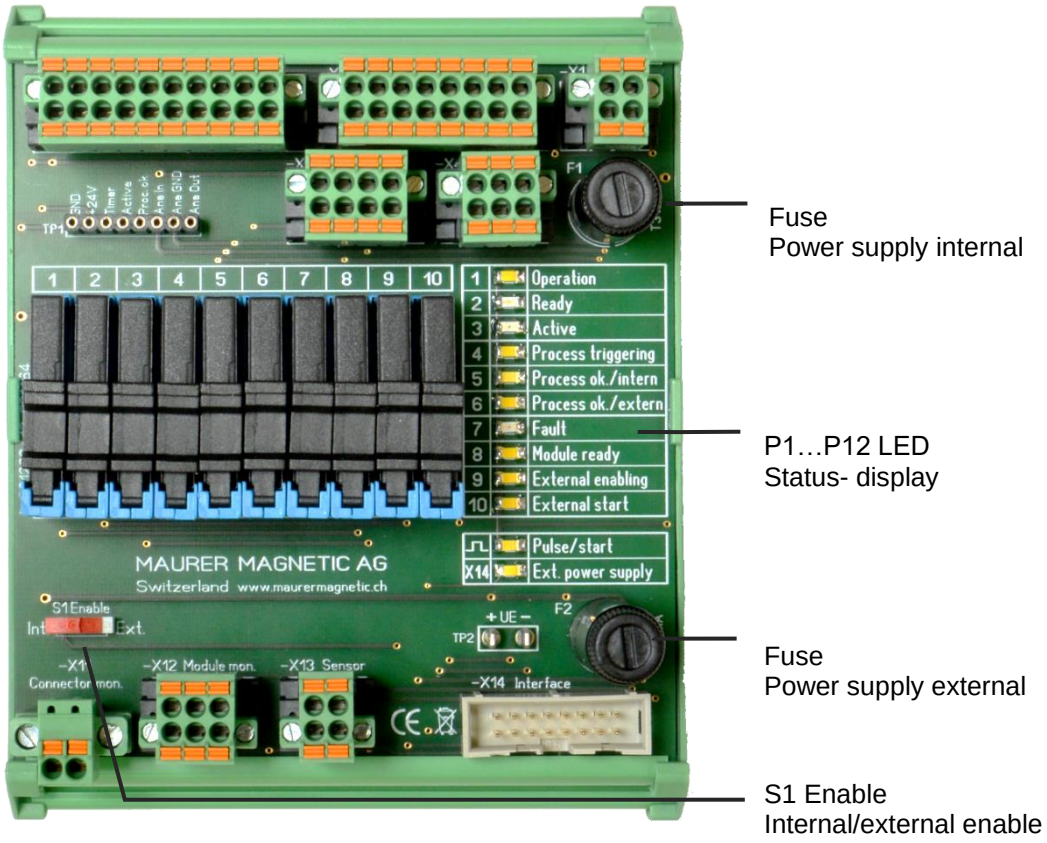

Figure 8: Interface board D-Sub15

6.5.11 Status LED P1… P12 description

Troubleshooting and analysis in chapter troubleshooting.

Nr	LED Indicator	Task	Colour
1	Operation	24VDC supply	white
2	Ready	Ready for demagnetization pulse	green
3	Active	Pulse currently running	yellow
4	Process triggering	Start process monitoring	white
5	Process ok/ int.	process monitoring internal ok	white
6	Process ok/ ext.	process monitoring external ok	white
7	Fault	general fault	red
8	Module ready	*Coil module connecter* connected, coil temperature ok	white
9	External enabling	External enabling signal ok (D-SUB15 interface)	white
10	External start	External start (D-SUB15 interface)	white
11	Pulse/ start	Pulse-/ Start button or external start (D-SUB15 or Sensor connector M12)	white
-X14	Ext. power supply	External power supply ok (D-SUB15 interface)	white

Table 4: Description LED interface module

6.5.12 Interface module fieldbus coupler

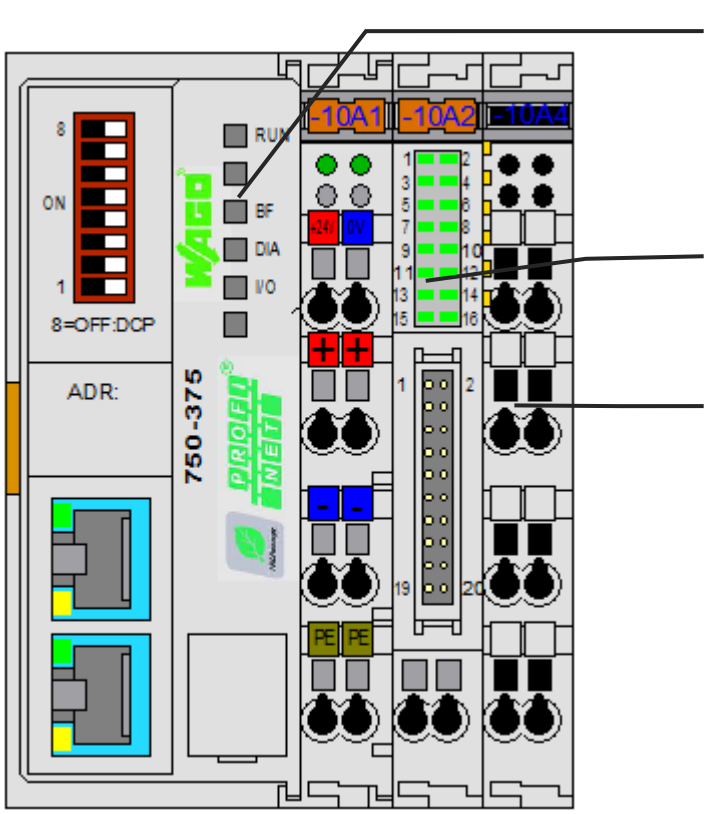

Figure 1: Fieldbus coupler (for example 750-375)

Description	Digital Input	Digital Output	Equipment identifying symb (EIS)	Function	Digitale In- /Outpı	Analog Input
Operation	1		-1A1-X7:1	1 = ok	DI 0.1	
Ready (Temp. Monitoring & Enabling & FC = ok)	2		-1A1-X7:2	1 = ok	DI 0.2	
Active (Demagnetization process on)	3		-1A1-X7:3	1 = ok	DI 0.3	
Process ok	4		-1A1-X7:4	1 = ok	DI 0.4	
General fault	5		-1A1-X7:5	1 = Fault	DI 0.5	
Coil module ready (Plug and configuration = ok)	6		-1A1-X7:6	1 = Ready	DI 0.6	
Coil overtemperature	7		-1A1-X7:7	1 = over Temp.	DI 0.7	
Fault fuse 24V (BUS / Blower)	8		-1A1-X7:8	1 = Fault	DI 0.8	
External Enabling		1	-1A1-X7:9	1 = Enabling	DO 0.1	
Reset		2	-1A1-X7:10	1 = Reset	DO 0.2	
Start Pulse		3	-1A1-X7:11	1 = Start Pulse	DO 0.3	
Reserve		4	-1A1-X7:12		DO 0.4	
Reserve		5	-1A1-X7:13		DO 0.5	
Power selection Step 1		6	-1A1-X7:14	1 = Step 1	DO 0.6	
Power selection Step 2		7	-1A1-X7:15	1 = Step 2	DO 0.7	
Power selection Step 3		8	-1A1-X7:16	1 = Step 3	DO 0.8	

Table 1: Descpription Fieldbus I/O

Further Information see wiring diagram

6.6 Power setting (MM DN750…1850, optional)

The power setting is chosen via either of the following options. A DN can only be equipped with one.

- Selector switch on control panel
- D-SUB9 power setting interface

The power setting allows selecting between 3 configured power settings. The following configuration are default settings. A customer-specific configuration is possible.

Setting	Default configuration
1	50% field strength
2	75% field strength
3	100% field strength

Table 5: Power setting (specifications for empty coil)

6.6.1 Power setting via selector switch

Select power setting via selector switch on control panel.

6.6.2 D-SUB9 power setting interface

Interface signals maximal current load 100mA.
D-Sub15 PIN14/15: 0...10 VDC Output maximal current load 1mA.

Do not connect D-Sub interface to a PC verbinden. PC and power module may be damaged.

Power settings can be controlled via *D-SUB9 power setting interface.* The interface is electrically isolated and requires external power supply.

6.6.3 Configuration D-Sub9 connector

Find the configuration and voltage range of the D-Sub9 connector in the appendix.

To select a power setting supply +24VDC to PIN1, PIN2 or PIN3. If no PIN is supplied the maximal field strength is selected.

PIN1/2/3 select setting 1/2/3

Do not supply +24VDC simultaneously to more than 1 PIN.
Do not change signal on PIN1/2/3 during demagnetization pulse.
Supply +24VDC on PIN1/2/3 during the entire length of the demagnatization pulse.

6.7 Continuous demagnetization

Depending on the coil module the machine can be configured for continuous demagnetization. The configuration is set up by Maurer Magnetic before delivery.

Continuous operation is controlled via *D-Sub15 Control Interface*. As long as +24VDC is supplied to PIN2 (*Start*) the demagnetization is active. When PIN2 drops to 0VDC the alternating field declines analogue to the pulse demagnetization.

6.8 Safety control

Interruption of power supply during demagnetization pulse leads to immediate pulse disruption.

- Parts in the vicinity of the coil are magnetised and need to be demagnetised once more
- Frequent interruption accelerates electric wear

The main switch (red/yellow) is an emergency stop button. Energy supply is immediately terminated (Safe stop 0).

Interruption of the *External enable signal* (see chapter *D-Sub15 Control Interface*) makes triggering a demagnetization pulse impossible. An already running pulse is completed. The energy supply is not terminated.

6.8.1 Safe Torque Off (STO), Optional

For integration in a centralized safety control, the DN power module can be equipped with an interface. Applications:

- Safety guard with/without guard control
- Mushroom pushbutton
- Safety light curtain

Triggering the STO leads to a Safe Stop category 1.
Further Information see wiring diagram DN.

7 Demagnetization

See manual coil module.

8 Maintenance

Maintenance, repairs and opening of the device only by skilled personell.

- Wait 10 minutes for capacitor discharge before opening

Opening of the inverter results in loss of warranty.

8.1 Daily maintenance interval

8.1.1 Visual check

- Supply cable (incl. cable relief)
- Coil module connector, connection cable (incl. cable relief)

8.2 Monthly maintenance interval

8.2.1 Visual check

- Housing damage
- Contamination can lead to short-circuits and failure of the device
- Breakaway torque check of electric connectors. Poor contacts can lead to heating and fire.

8.2.2 Functional check

- Control elements and indicators
- Emergency stop
- Demagnetization check: Measurement of residual magnetism at demagnetized objects.

8.2.3 Maintenance

- General cleaning

8.3 Yearly maintenance interval

8.3.1 Functional check

- Maximal current check according to chapter Troubleshooting

8.4 Spare and wear parts

Find a list of spear and wear parts including delivery time below. Find manufacturer and part numbers in the enclosed circuit diagram. Prices on request.

Part	Delivery times MMAG
Time relay	1 week
Motor circuit breaker	1 week
Optocoupler	1 week
Capacitor if present	1 week
Interface module	1 week
Inverter replacement	1-2 weeks
Mains filter	1-2 weeks

Table 6: Spare and wear parts

8.4.1 Fuse protection

	DN150	DN750-1850
1A1-F1, 1A1-F2: Interface module	20x5mm, slow-blow 315mA (2x)	
1FT1: Secondary-fuse 24VDC power supply	-	20x5mm, slow-blow 1A
1FT2: *Fan connector* fuse	-	20x5mm, slow-blow 4A

Blown fuses 1FT1 and 1FT2 are indicated by an LED on fuse carrier.

8.4.2 Inverter replacement

The Inverter is specially configured by Maurer Magnetic. For replacement the serial number of power and coil module is required.

8.5 Decommissioning

Authorised and competent persons may only carry out decommissioning. Always observe the accident prevention regulations!

8.5.1 Disassemble

The following steps are necessary for proper dismantling:

- Switch off the system and secure it against unauthorised restarting
- Wait at least 10 minutes after switching off to ensure a safe discharge of the capacitors
- Disconnect the power supply to the power module
- Disconnect all other loads from the power module (control cable connection box of the coil and the fan, control box, safety scanner, capacitor box, etc.)

8.5.2 Disposal

Resources and the environment can be saved by proper disposal. Please note that no components have been installed that require disposal in hazardous waste.
Dispose of the machine at a scrapping off plant or an approved collection point. Before the machine is disposed of, the following materials must be removed and handed over separately to the various disposal points in compliance with the legal requirements for environmental hygiene:

- Electrical and electronic components: Remove electrical components in the control cabinet and in the coil. Pay attention to occupational safety: Support and secure heavy parts before disassembly.
- Disassemble and dispose of metal parts separately: e.g. copper (such as strands of the control cabinet wiring and wire of the coil), sheet metal (e.g. control cabinet), aluminium (e.g. top-hat rails in the control cabinet), scrap metal (various screws etc.)
- Disassemble plastic parts and hard fabric plates (spool housing, spool insert, etc.)

If uncertainties arise during disposal, please contact a scrapping off company or an approved collection point.

9 Troubleshooting

9.1 *Ready* lamp dark / no *Ready* signal:

- *Coil module monitoring M8* not connected
- *Coil module connector* not connected
- „S1 Enable“ on Interface board on position „EXT.“ **and** no signal (+24VDC) on *External enable* (PIN10)

9.2 *Active* lamp flashing / *Active* Signal flashing (5 Hz)

- Coil lamp flashes yellow
- Coil is hot / close overheating. Operation remains possible
- Check Connection *Temp 2 Sensor* in Connection Box coil module

9.3 *Fault* lamp flashing / *Fault* Signal flashing (5 Hz)

- Overheating of coil module: too low cycle time leads to overheating of the coil. A temperature switch blocks further pulse triggering. After cool-down, pulse triggering is enabled again.
    - *Ready* lamp dark/signal LOW, Connection box lamp red flashing
    - Cool down coil and possibly decrease cycle time

9.4 *Fault* lamp indicates / +24VDC on *Fault* signal:

- Switch off, wait 30 seconds, switch back on
- Check power supply inverter. In DN750-1850 check motor circuit breaker
- If *Fault* still indicates: open DN, record error message, contact Maurer Magnetic AG

9.5 *Process OK* lamp dark / no *Process OK* signal:

- Process monitoring only works at 100% power setting (optional)
- Check *Ready* signal
- Check *Active* signal during demagnetization
- In combination with a VE coil module the coil current decreases with increasing ferromagnetic material in the coil. In extreme cases the current does not reach the target value and the *Process OK* is not triggered. To avoid this the machine can be configured by Maurer Magnetic AG for specific parts.
- Process monitoring relay defect/manipulation
- Demagnetization pulse check with oscilloscope. See below

9.6 False triggering of the RCCB, ELCB

If a RCCB or ELCB is used it needs to be a Type B, suitable for protecting frequency inferters.

Due to the built in frequency inverter, higher than normal leakage currents can occur at ~450 Hz. These can falsely trigger the RCCB. A leakage compensation[2] can compensate leakage currents at frequencies typical for frequency inverters und thus prevent false triggering.

9.7 Insufficient demagnetization

Demagnetization process

- Check demagnetization process according to chapter demagnetization in coil module manual
- Is object in coil during the entire pulse duration?

Have objects to be demagnetized changed?

- Material, treatment, magnetization, supplier (Material changes within supplier tolerances are not communicated but can affect demagnetization)
- Has the amount of objects changed?
- Has the container changed? Ferromagnetic containers have a shielding effect.

Machine inspection:

Attention: maximum coil current and maximum field strength flow only during ~0.1…0.7s.

- Inspection of contact pins *Coil module connector* (HAN)
- Measurement of (reference measurements according to enclosed inspection protocol):
    - Electric resistance coil module
    - Inductivity coil module
    - Maximal coil current: with suitable current clamp[3] on *Coil module connector*
    - Maximal field strength: Mean value of corner and centre measurement
    - Demagnetization pulse check with oscilloscope see below

[2] Suitable type: LEAKCOMP HP, EPA GmbH
[3] Suitable current clamps: Fluke 80i-110s AC/DC Current Clamp, Fluke i1000s AC Current Probe

9.8 Demagnetization pulse check

- Prepare suitable current clamp[3] and oscilloscope
- Open power module
- Clamp current clamp around power cable a *Coil module connector*
- Trigger pulse and record current over entire pulse length
- Maximal current (RMS) corresponds to the value in the inspection protocol
- Take a picture of the pulse (example see below) and send incl. setup current clamp (mV/A) to Maurer Magnetic AG for analysis

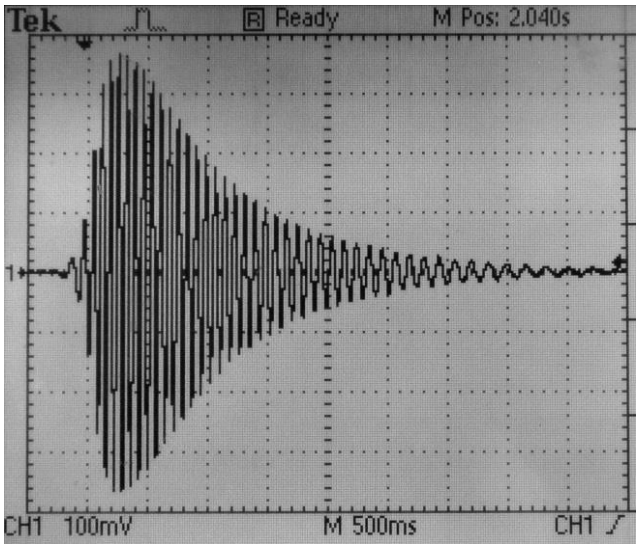

Figure 9: Measurement demagnetization pulse

9.9 Malfunction external coil fan at *Fan connector*

Inspect fuse 1FT2: Fuse *Fan connector*

9.10 Error analysis LED interface board

LED	Function	LED bright	LED dark	Error cause	Colour
-P1	Operation	Internal 24VDC supply ok	No internal 24VDC power supply	Main switch „off“ Inspect fuses: 1F1,1FT1,1A1-F1	white
-P2	Ready	*Coil module connector* connected Coil temperature ok Inverter ok *External enable* ok	*Coil module connector* connected Coil temperature ok Inverter ok *External enable* ok	Check *Coil module connector* Check *Coil module monitoring M8* Check coil temperature, *coil fan,* filter pad Error-code inverter > send to MMAG Check Switch S1 Enable int/ext	green
-P3	Active	Pulse running Inverter in RUN mode	Pulse completed, no pulse running	Check –P1 „Operation“ Check –P2 „Ready“	yellow
-P4	Process triggering	Start process monitoring	End process monitoring	Check –P3 „Active“	white
-P5	Process ok/ int.	Process monitoring internal ok	End process monitoring internal Process failed	Check –P4 „Process triggering“ General process error	white
-P6	Process ok/ ext.	Process monitoring external ok	End process monitoring external Process failed	Check –P5 „Process ok intern“	white
-P7	Fault	General fault	No fault	Switch off, wait 30s, switch on Check circuit breaker inverter Error-code inverter > send to MMAG	red
-P8	Module ready	*Coil module connector* connected Coil temperature ok	*Coil module connector* connected Coil temperature ok	Check *Coil module connector* Check *Coil module monitoring M8* Check coil temperature, *coil fan,* filter pad	white
-P9	External enabling	External enable ok (D-SUB15 Interface)	No external enable signal	Switch S1 auf Int. No external enable signal D-SUB 15 or <16VDC	white
-P10	External start	External start (D-SUB15 Interface)	No external start (D-SUB15 Interface)	No external start signal D-SUB 15 or <16VDC	white
-P11	Pulse/ start	Pulse-/Start button is pushed or external start signal ok (D-SUB15 or Sensor connector M12)	Pulse-/Start button not pushed or external start signal not ok	Check –P1 „Operation“ Check –P2 „Ready“ Start signal shorter than 100 ms	white
-X14	Ext. power supply	External 24VDC power supply not ok (D-SUB15)	External 24VDC power supply not ok (D-SUB15)	Check fuse 1A1-F2 Check voltage reversal +/- Check voltage range 16-30VDC	white

Table 7: Error analysis interface board

10 Specifications

10.1 General

	DN150	DN750	DN1100	DN1850
Dimensions (W x H x D)	300x400x210 mm	600x600x350 mm		
Weight	12 kg	45 kg	45 kg	50 kg
Standard	DIN EN 60204-1			
IP code	41			

Table 8: General Specifications

10.1.1 Minimal cycle times

Cycle times below specification may lead to overheating of the coil. Pulse triggering is blocked („Ready“ indicator dark, no „Ready“ signal). After cooldown pulse triggering is enabled again.

Coil module	DN150	DN750-1850
CT-U	1 Pulse / 10 s	1 Pulse / 10 s
KE	1 Pulse / 40 s	
SE	-	1 Pulse / 40 s
VE-2/4	-	According manual coil module
Others	According manual coil module	

Table 9: Minimal cycle times

10.2 Power supply

	DN150	DN750	DN1100	DN1850
Supply voltage[4]	1-phasig, 200…240 VAC	3-phasig, 380…480 VAC		
Frequency range	50…60 Hz ± 5%			
Pre-fuse supply min.	13 A	16 A	20 A	25 A
Pre-fuse supply max.	16 A	25 A	25 A	25 A

Table 10: Power supply

[4] Reduced power output for supply voltage for supply voltages below 230/400 VAC

10.3 Output

	DN150	DN750	DN1100	DN1850
Voltage max [5] [6]	1-phase, 230 VAC	1-phase, 400 VAC		
Nominal power [7]	1.5 kW	7.5 kW	11 kW	18.5 kW
Nominal max. current RMS [8]	14 A for 0.5s	25.5 A for 1s	37.5 A for 1s	57 A for 1s
Nominal max. power (at 230/400VAC supply current)	2.8 kVA for 0.5s	12 kVA for 3 s	17 kVA for 3 s	26 kVA for 3 s

Table 11: Ausgang

10.3.1 *Fan connector*

	DN150 (optional)	DN750-1850
Voltage range	220…240VAC (50/60Hz)[9]	0…24 VDC
Fuse protection	10A	4A
Connector:	Phoenix Contact SACC-E-MINFS-3CON-PG13/0,5	Phoenix Contact SACC-E-MINFS-5CON-PG13/0,5

Table 12: *Fan connector*

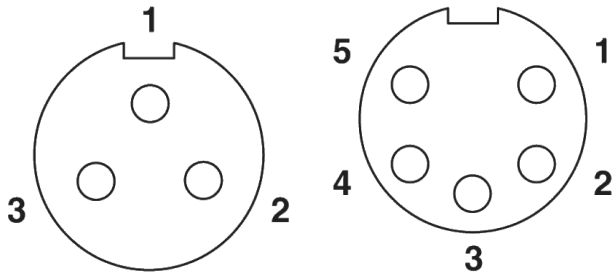

Figure 10: Configuration *Fan connector* DN150 (left) / DN750-1850 (right)

Configuration

PIN	DN150	DN750-1850
1	PE	- (not connected)
2	L	0V
3	N	PE
4	- (not available)	+24V
5	- (not available)	- (not connected)

Table 13: PIN-configuration

[5] Output voltage subject to parameterisation. Noted values correspond to maximal values.
[6] The maximum output voltage can't exceed the supply voltage
[7] At 100% duty cycle
[8] At 230/400VAC supply current. Reduced current/power with lower supply voltages
[9] Corresponds to supply voltage/frequency

10.4 Control signals

Interface signals maximal current load 100mA.
D-Sub15 PIN14/15: 0...10 VDC Output maximal current load 1mA.

Do not connect D-Sub interface to a PC verbinden. PC and power module may be damaged.

D-Sub interfaces are potentially seperated and require 24VDC power supply provided by the customer.

	DN150	DN750-1850
Coil module monitoring M8	0…24 VDC, <100mA	
Sensor connector M12	0…24 VDC, 200mA	0…24 VDC, 100mA
D-Sub15 Control Interface	0…24 VDC, <100mA, PIN14/15: 0...10 VDC <1 mA	
D-Sub09 power setting interface	0…24 VDC, <100mA	

Table 14: Control Signals

10.4.1 Sensor connector M12

	DN150	DN750-1850
Voltage range	0…24 VDC	
Maximum current	100mA	
Connector:	Device socket M12 4-pin Pole no. 4	

Configuration

PIN	Type	Colour	Voltage	Role
1	Output	brown	24VDC	Light barrier supply +24V
2	Input	white	24VDC	Light barrier signal
3	Output	blue	24VDC	Light barrier 0V
4	-	black	24VDC	-

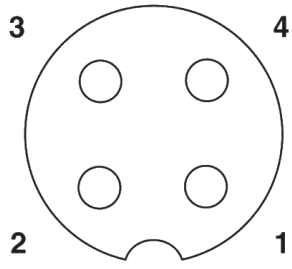

Figure 11: Configuration connector M12

10.4.2 D-Sub15 control interface

The signals (except PIN14/15) are potentially separated

	PIN1-13	PIN14/15 (not potentially separated)
Nominal voltage	24VDC	10VDC
Voltage range	16…30VDC	0…10VDC
Maximal pre-fuse	F2A (2A fast-acting)	-
Internal fuse	T315mA	-
Internal fuse (Supply client)	T315mA	-
Nominal voltage HIGH	24VDC	-
Range HIGH	16-30VDC	-
Nominal voltage LOW	0VDC	-
Release voltage LOW	10VDC	-
Gate current at UN	7mA	-
Input impedance @ 20°C	3.2 kΩ	-
Output current max. @ 20°C	100mA	1mA

Table 15: D-Sub15 Interface

Configuration

PIN	Type	Voltage	Role
1	Input		Customer power supply 0VDC, reference potential
2	Input	24VDC	*Start*
3	Output	24VDC	*Ready*
4	Output	24VDC	*Fault*
5	Output	24VDC	*Active*
6	Output	24VDC	*Operation lamp*
7	Output	24VDC	*Process OK* (Process monitoring, Optional)
8	-		
9	-		
10	Input	24VDC	*External enable*
11	Output	24VDC	*Module OK*
12	Input	24VDC	Customer power supply 24VDC
13	-		
14	Output	10VDC	*Analog out* (signal 0…10V / 0…100% field strength)
15	Output	10VDC	Reference potential to PIN14

Table 16: PIN-Belegung D-Sub15

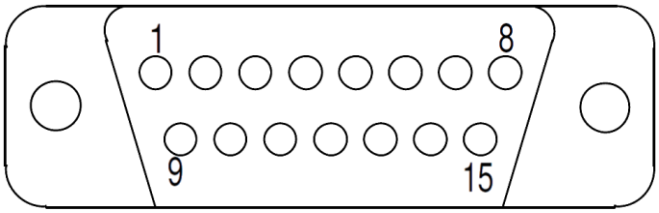

Figure 12: Configuration connector D-Sub15

10.4.3 D-Sub9 power setting interface (optional, DN750-1850)

	PIN1-09
Nominal voltage	24VDC
Voltage range	19.2-28.8VDC
Nominal voltage HIGH	24VDC
Range HIGH	19.2-28.8VDC
Nominal voltage LOW	0VDC
Release voltage LOW	10VDC
Gate current at UN	7mA

Table 17: D-Sub09 power setting interface

Configuration

The signals are potentially separated

PIN	Type	Voltage	Role
1	Input	24VDC	Select *setting 1*
2	Input	24VDC	Select *setting 2*
3	Input	24VDC	Select *setting 3*
4	-	-	-
5	-	-	-
6	-	-	-
7	-	-	-
8	-	-	-
9	0V	24VDC	Power supply 0VDC, reference potential

Table 18: Configuration D-Sub9

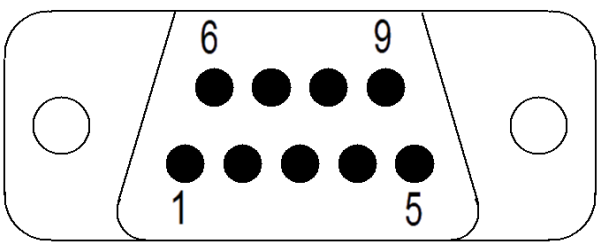

Figure 13: Configuration connector D-Sub9

10.5 Ambient conditions

10.5.1 Operation

	DN150	DN750	DN1100	DN1850
Temperature range ambient air[10]	-10 °C to 40 °C No formation of ice in device.			
Relative humidity	Max 90%, no condensate formation			
Ambient conditions	Indoor use only, no aggressive gases, no oil dust, dust-/dirt-free assembly			
Altitude	Up to 1000m above sea level. Above derate 3% for every 500m up to 2500m.			
Vibration resistance	Max. 5.9 m/s^2			

Table 19: Ambient conditions Operation

10.5.2 Storage

	DN150	DN750	DN1100	DN1850
Temperature range ambient air	-20 °C to 65 °C			
Relative humidity	Max 90%, no condensate formation			
Vibration resistance	Max. 5.9 m/s2			

Table 20: Ambient conditions storage

[10] During Operation above 40° C the maximal cycle time is reduced

11 Standard Warranty

Maurer Magnetic AG guarantees operation of the delivered demagnetization units. The warranty is equivalent to the warranty / guarantee supplement valid at order date

The warranty expires in case of damage to the device by third-party components. Use only components (coil modules, demagnetization cables, power units) from Maurer Magnetic AG.

The warranty expires in case of equipment damage through inappropriate combination of components. Maurer Magnetic AG components (coil modules, demagnetization cables, power units) are commissioned combined internally and parameterised accordingly. They must be used exclusively in combination expressly provided for.

Maurer Magnetic AG cannot be held liable for direct or indirect damage, as well as consequential damage resulting from the false or improper use of the devices from the series MM DN150...1850.

The demagnetization power modules MM DN150...1850 have been designed according to CE regulations and in accordance with general due diligence.

A warranty extension must be agreed in writing.

Maurer Magnetic

Maurer Magnetic AG is specialised in demagnetization. We offer a varied choice of demagnetization processes.

Metrology residual magnetism

Measurement devices

Zero-Gauss-Chambers

MaurerClassic

Hand-held demagnetizer

Loop demagnetizer

MaurerClassic+

Yoke demagnetizer

Maurer-Degaussing-Technology

FMT®-Technology

CFT®-Technology

Shielding chambers

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