

Contactors and Relays

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Contactors and Relays

Contactor relays

Contactor relays

Contactor relays are often used in control and regulating functions. They are used in large quantities for the indirect control of motors, valves, clutches and heating equipment.

In addition to the simplicity which they offer in project engineering, panel building, commissioning and maintenance, the high level of safety which they afford is a major factor in their favour.

Safety

The contactor relay contacts themselves constitute a considerable safety feature. By design and construction they ensure electrical isolation between the actuating circuit and the operating circuit, in the de-energized state, between the

contact input and output. All Moeller contactor relays have double-break contacts.

The German Trade Associations demand that, for control systems of power-driven metalwork presses, the contacts of contactors must be interlocked. Interlocking means that the contacts are mechanically connected to one another such that break contacts and make contacts can never be closed simultaneously. At the same time, it is necessary to ensure that the contact gaps are at least 0.5 mm over the entire life, even when defective (e.g. when a contact is welded). The contactor relays DILER and DILA fulfil this requirement.

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Moeller contactor relays

Moeller offers two ranges of contactor relays as a modular system:

- Contactor relays DILER,
- Contactor relays DILA.

and the modules are described on the following pages.

Modular system

The modular system has many advantages for the user. The system is formed around basic units, which are equipped with additional functions by means of modules. Basic units are intrinsically functional units, consisting of an AC or DC drive and four auxiliary contacts.

Modules having auxiliary functions

Auxiliary contact modules having 2 or 4 contacts. The combination of normally open and normally closed contacts is according to EN 50011. The auxiliary contact modules of the contactors DILEM and DILM cannot be snapped onto the basic device to prevent duplication of terminal markings e.g. contact 21/22 on the basic unit and 21/22 on the add-on auxiliary contact module.

Contactors and Relays

Contactor relays

The system and the Standard

European Standard EN 50011 "Terminal markings, reference numbers and reference letters for certain contactor relays" has a direct bearing on the use and application of the modular system. There are various types, which the Standard differentiates between by means of reference numbers and reference letters, depending on the number and position of the make and break contacts in the device, and their terminal markings.

Ideally devices with the reference letter E should be used. The basic devices DILA-40, DILA-31, DILA-22 as well as DILER-40, DILER-31 and DILER-22 comply with the E version.

For 6 and 8 pole contactor relays, the "E" version means that four make contacts must be arranged in the lower/rear contact level. If, for example, the available auxiliary contact modules are used in the DILA-22 and DILA-3131, they result in contact combinations with reference letters X and Y.

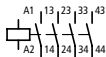
Below are 3 examples of contactors with 4 normally open and 4 normally closed contacts with different reference letters. Version E is to be preferred.

Example 1

DILA-XHI04



+
DILA-40



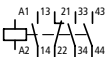
△ 44 E
DILA40/04

Example 2

DILA-XHI13



+
DILA-31



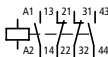
△ 44 X
DILA31/13

Example 3

DILA-XHI22



+
DILA-22

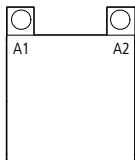


△ 44 Y
DILA22/22

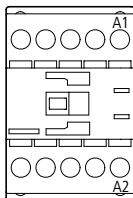
Contactors and Relays

Contactors relays

Coil connections



DILER



DILA

On the contactor relay DILA the coil connection A1 is at the top and A2 at the bottom. As suppressor circuits the following are connected on the front :

- RC suppressors
- Varistor suppressors

The DC operated contactors DILER and DILA have an integrated suppressor circuit.

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On the top positioned terminals A1–A2 of the contactor DILER the following accessories are connected to limit the relay coil switch off voltage peaks :

- RC suppressors
- Diode suppressors
- Varistor suppressors

Suppressor circuits

Electronic equipment is nowadays being increasingly used in combination with conventional switching devices such as contactors. This equipment includes programmable logic controllers (PLCs) timing relays and coupling modules, whose operation can be adversely affected by disturbances from interactions between all the components.

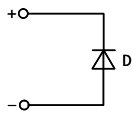
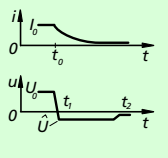
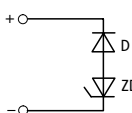
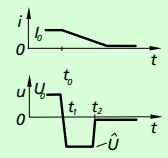
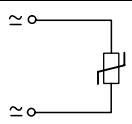
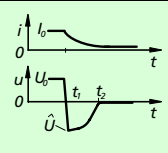
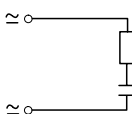
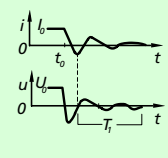
One of the disturbance factors occurs when inductive loads, such as coils of electromagnetic switching devices, are switched off. High cut-off induction voltages can be produced when such devices are switched off and, under some circumstances, can destroy adjacent electronic devices or, via capacitive coupling mechanisms, can generate interference voltage pulses and thus cause disruptions in operation.

Since interference-free disconnection is impossible without an accessory, the coils may be connected to a suppressor module, depending on the application. The advantages and disadvantages of the various suppressor circuits are explained in the following table.

Notes

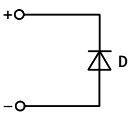
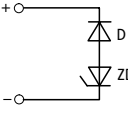
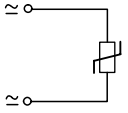
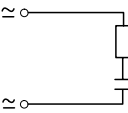
Contactors and Relays

Contactor relays

Circuit diagram	Load current and voltage responses	Proof against incorrect connection also for AC	Additional dropout delay	Induction voltage limiting defined
<div style="background-color: #00FF00; color: white; padding: 2px; font-weight: bold; display: inline-block;">5</div> 		-	Very long	1 V
		-	Medium	U_{ZD}
		Yes	Short	U_{VDR}
		Yes	Short	-

Contactors and Relays

Contactor relays

Circuit diagram	Damping also below U_{LIMIT}	Increased rating with circuitry.	Remarks	
	–	–	Advantages:	Dimensioning uncritical. Minimum possible induction voltage, Very simple and reliable.
			Disadvantage:	Long drop-out delay
	–	–	Advantages:	Very short drop-out delay. Dimensioning uncritical. Simple construction
			Disadvantage:	No damping below U_{ZD}
	–	–	Advantages:	Dimensioning uncritical. High energy absorption. Very simple construction
			Disadvantage:	No damping below U_{VDR}
	Yes	Yes	Advantages:	HF damping due to stored energy. Immediate de-energisation. Highly suitable for AC.
			Disadvantage:	Precise dimensioning required

Contactors and Relays

Timing and special purpose relays

Electronic timing relays are used in contactor control systems which require short reset times, high repetition accuracy, high switching frequency, and a long component lifespan. Times between 0.05 s and 100 h can be easily selected and set.

The switching capacity of electronic timing relays corresponds to the utilisation categories AC 15 and DC 13.

In terms of the actuating voltages there are with timing relays the following differences :

- **Version A** (DILET... and ETR4) Universal devices:
DC 24 to 240 V
AC 24 to 240 V, 50/60 Hz
- **Version W** (DILET... and ETR4) AC devices:
AC 346 to 440 V, 50/60 Hz
- **ETR2...** (as row mounting device to DIN 43880)
Universal device:
DC 24 to 48 V
AC 24 to 240 V, 50/60 Hz

The functions of each of the timing relays are as follows:

- DILET11, ETR4-11, ETR2-11
Function 11 (on-delayed)
- ETR2-12
Function 12 (off-delayed)
- ETR2-21
Function 21 (fleeting contact on energisation)
- ETR2-42
Function 42 (flashing, pulse initiating)

- ETR2-44
Function 44 (flashing, two speeds; can be set to either pulse initiating or pause initiating)
- Multifunction relay DILET70, ETR 4-69/70
Function 11 (on-delayed)
Function 12 (off-delayed)
Function 16 (on and off delayed)
Function 21 (fleeting contact on energisation)
Function 22 (fleeting contact on de-energisation)
Function 42 (flashing, pulse initiating)
- **Function 81** (pulse generating)
Function 82 (pulse shaping)
ON, OFF
- Multifunction relay ETR2-69
Function 11 (on-delayed)
Function 12 (off-delayed)
Function 21 (fleeting contact on energisation)
Function 22 (fleeting contact on de-energisation)
Function 42 (flashing, pulse initiating)
Function 43 (flashing, pause initiating)
Function 82 (pulse forming)
- Star/delta timing relay ETR4-51
Function 51 (on delayed)

With both DILET70 and ETR4-70 an external potentiometer can be connected. Upon connection, both timing relays automatically recognize that a potentiometer is fitted.

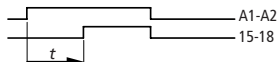
The ETR4-70 has a special feature. Equipped with two change-over contacts which can be converted to two timing contacts 15-18 and 25-28 (A2-X1 bridged) or one timing contact 15-18 and a non-delayed contact 21-24 (A2-X1 not bridged). If the link A2-X1 is removed, only the timed contact 15-18 carries out the functions described below.

Contactors and Relays

Timing and special purpose relays

Function 11

On-delayed

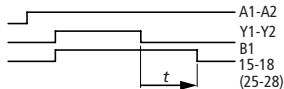


The control voltage U_s is applied via an actuating contact to the terminals A1 and A2.

After the set delay time the change-over contact of the output relay goes to the position 15-18 (25-28).

Function 12

Off-delayed

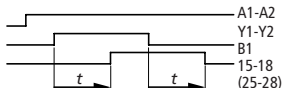


After the control voltage has been applied to the terminals A1 and A2, the changeover contact of the output relay remains in the original position 15-16 (25-26). If the terminals Y1 and Y2 in the DILET70 are linked by a potential-free make contact or, in the case of the ETR4-69/70 or ETR2-69, a potential is applied to B1, the changeover contact changes without delay to the position 15-18 (25-28).

If the connection between the terminals Y1-Y2 is now interrupted, or B1 is separated from the potential, once the set time has elapsed, the changeover contact returns to its original position 15-16 (25-26).

Function 16

On- and Off-delayed

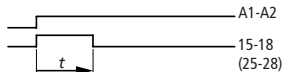


The control voltage U_s is applied directly to the terminals A1 and A2. If the terminals Y1 and Y2 in the DILET70 are linked by a potential-free contact, or in the case of the ETR4-69/70 a potential is applied to B1, after a set time t the changeover contact goes to the position 15-18 (25-28).

If the connection Y1-Y2 is now interrupted, or B1 is separated from the potential, the changeover contact goes back to its original position 15-16 (25-26) after the same time t .

Function 21

Fleeting contact on energization



After the voltage U_s has been applied to A1 and A2, the changeover contact of the output relay goes to position 15-18 (25-28) and remains actuated for as long as the set fleeting contact time.

A fleeting pulse (terminals 15-18, 25-28) of defined duration is therefore produced from a two-wire control process (voltage on A1/A2) by this function.

Contactors and Relays

Timing and special purpose relays

Function 82

Pulse forming

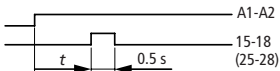


After the control voltage has been applied to A1 and A2, the changeover contact of the output relay remains in the rest position 15-16 (25-26). If the terminals Y1 and Y2 in the DILET70 are linked by a potential-free contact, or in the case of the ETR4-69/70 or ETR2-69, a potential is applied to B1, the changeover contact changes without delay to the position 15-18 (25-28).

If Y1-Y2 is now opened again, or B1 is separated from the potential, the changeover contact remains actuated until the set time has elapsed. If, instead, Y1-Y2 remain closed or B1 is separated from the potential for longer, the output relay likewise changes back to its rest position after the set time. An output pulse of precisely defined duration is thus produced in the pulse-forming function, irrespective of whether the input pulse via Y1-Y2 or B1 is shorter or longer than the set time.

Function 81

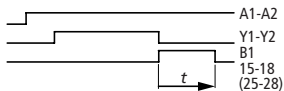
Pulse generating with fixed pulse



The actuating voltage is applied to the terminals A1 and A2 via an actuating contact. After the set delay time has elapsed the changeover contact of the output relay goes to position 15-18 (25-28) and returns to its original position 15-16 (25-26) after 0.5 s. This function is therefore a fleeting pulse with a time delay.

Function 22

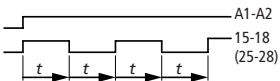
Fleeting contact on de-energization



The control voltage U_s is applied directly to A1 and A2. If the terminals Y1 and Y2 of the DILET70, that have been shorted (DILET-70 potential-free) before at a convenient time, are opened again (or for ETR4-69/70 or ETR2-69 the contact B1 again potential-free) the contact 15-18 (25-28) closes for the duration of the set time.

Function 42

Flashing, pulse initiated



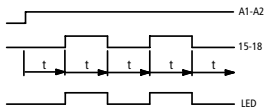
After the voltage U_s has been applied to A1 and A2, the changeover contact of the output relay changes to position 15-18 (25-28) and remains actuated for as long as the set flashing time. The subsequent pause duration corresponds to the flashing time.

Contactors and Relays

Timing and special purpose relays

Function 43

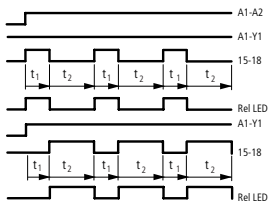
Flashing, pause initiated



After the voltage U_s has been applied to A1 and A2 the change-over contact of the output relay stays in position 15-16 for the set flashing time and after the duration of this time goes to position 15-18 (the cycle begins with a pause phase).

Function 44

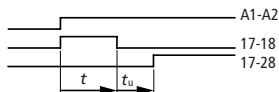
Flashing, two speeds



After the voltage U_s has been applied to A1 and A2 the change-over contact of the output relay goes to position 15-18 (pulse begin). By bridging the contacts A1 and Y1 the relay can be switched to pause begin. The times t_1 and t_2 can be set to different times.

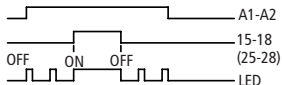
Function 51 Star-delta

On-delayed



When the control voltage U_s is connected to A1 and A2 the instantaneous contact goes to position 17-18. After the set time duration the instantaneous contact opens and the timing contact 17-28 closes after a changeover time t_u of 50 ms.

On-Off Function

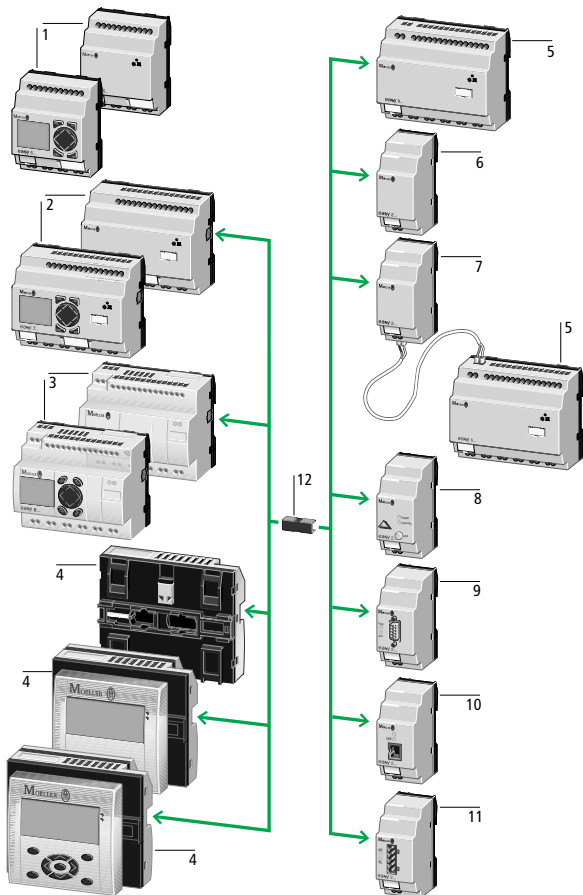


The On-Off function allows the operation of a control system to be tested and is an aid, for example, for commissioning. The Off function allows the output relay to be de-energized and it no longer reacts to the functional sequence. The On function energizes the output relay. This function is dependent on the supply voltage being applied to the terminals A1/A2. The LED indicates the operational status.

Contactors and Relays

Control relay easy, Multi Function Display MFD-Titan®

Control relay easy



Contactors and Relays

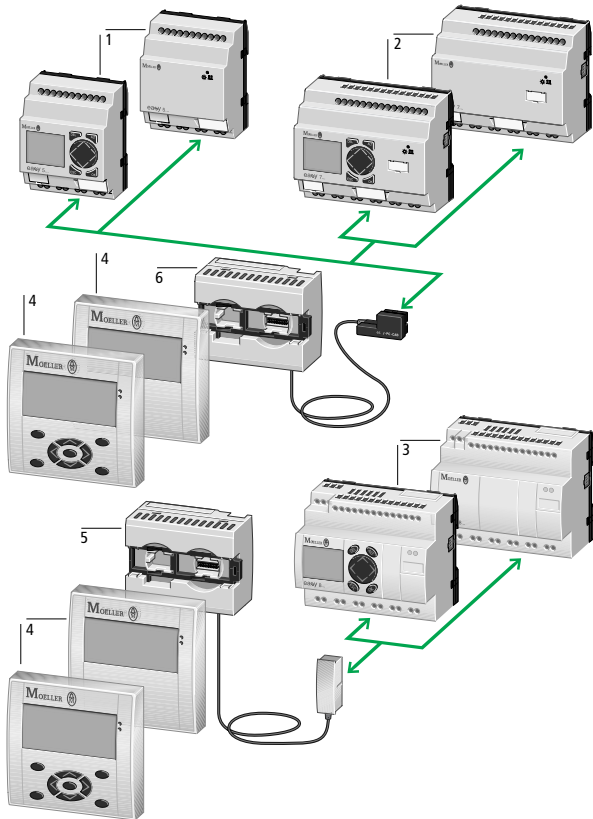
Control relay easy, Multi Function Display MFD-Titan®

- 1 Basic unit easy512
- 2 Basic unit, expandable easy719, easy721
- 3 Basic unit, expandable easy819, easy820, easy821, easy822
- 4 Multi Function Display MFD-Titan, expandable
- 5 Expansion unit easy618, easy620
- 6 Expansion unit easy202
- 7 Coupling unit easy200 for remote expansion of easy700, easy800 and MFD-Titan
- 8 Network module PROFIBUDS-DP; EASY204-DP
- 9 Network module AS-Interface; EASY205-ASI
- 10 Network module CANopen; EASY221-CO
- 11 Network module DeviceNet; EASY222-DN
- 12 Data plug EASY-LINK-DS

Contactors and Relays

Control relay easy, Multi Function Display MFD-Titan®

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Contactors and Relays

Control relay easy, Multi Function Display MFD-Titan®

- 1 Basic unit easy512
- 2 Basic unit, expandable easy719, easy721
- 3 Basic unit, expandable easy819, easy820, easy821, easy822
- 4 Multi Function Display MFD-Titan
- 5 Power supply/communication module MFD-CP4-800
- 6 Power supply/communication module MFD-CP4-500

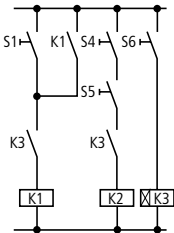
Contactors and Relays

Control relay easy, Multi Function Display MFD-Titan®

Programming instead of wiring

Circuit diagrams are the basis of all electrotechnical applications. In practice electrical devices are wired to each other. With the control relay easy it is simply by pushbutton or with easy to use easy-soft... by computer. Simple menu operation in many languages simplify the input. That saves time and therefore costs. easy and MFD-Titan are the professionals for the world market.

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“Remote” Display – Text display for easy500, easy700, easy800 in IP65

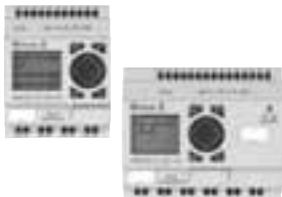


Using Plug & Work the display MFD-80.. is connected via the supply and communication module MFD-CP4.. to the easy. The MFD-CP4.. has an integrated, 5 m long connection cable. Advantage: No software or driver is necessary for connection. The MFD-CP4.. offers real Plug & Work. The input and output wiring is connected to the easy. The MFD-80.. is mounted into two 22.5 mm mounting holes. The IP65 display is background illuminated and easily readable. Individual labeling of the displays is possible.

Contactors and Relays

Control relay easy, Multi Function Display MFD-Titan®

Control relay easy500 and easy700

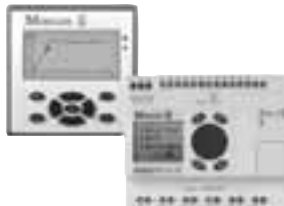


easy500 and easy700 have the same functions. easy700 offers more inputs and outputs, is expandable and can be connected to a standard bus system. The series and parallel linking of contacts and coils takes place in up to 128 current paths. Three contacts and a coil in series. The display of 16 operating and report texts is via an internal or external display.

The main functions are:

- Multi-function timing relay
- Current impulse relay,
- Counter
 - forwards and backwards,
 - Fast counter,
 - Frequency counter,
 - Operational time counter,
- Analog value comparator,
- Week and year time switch,
- Automatic summertime changeover,
- Remanent actual values of markers, numbers and timing relays.

MFD-Titan and easy800



MFD...CP8... und easy800 have the same functions. MFD-80.. with IP65 they can be used in harsher environments. In addition for expansion and connection to standard bus systems 8 easy800 or MFD-Titan can be networked via easyNet. The series and parallel linking of contacts and coils takes place in up to 256 current paths. Four contacts and a coil in series. The display of 32 operating and report texts is via an internal or external display.

Extra to the functions offered by easy700 the easy800 and the MFD-Titan offers:

- PID controller,
- Arithmetic modules,
- Value scaling,
- and much more.

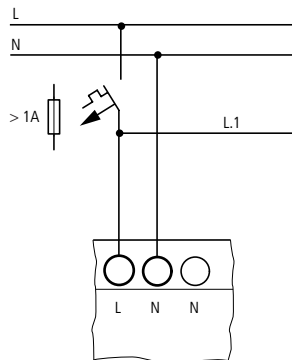
Individual labeling of the MFD-80 is possible.

Contactors and Relays

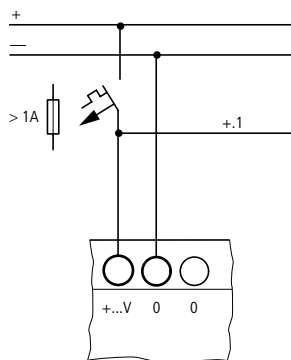
Control relay easy, Multi Function Display MFD-Titan®

Power supply connection

for AC devices



for DC devices



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Basic unit

EASY512-AB-...	24 V AC
EASY719-AB-...	24 V AC
EASY512-AC-...	115/230 V AC
EASY719-AC-...	115/230 V AC
EASY811-AC-...	115/230 V AC

MFD-AC-CP8-...	115/230 V AC
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Expansion devices

EASY618-AC-...	115/230 V AC
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Basic units

EASY512-DA-...	12 V DC
EASY719-DA-...	12 V DC
EASY512-DC-...	24 V DC
EASY719-DC-...	24 V DC
ASY819-DC-...	24 V DC
EASY82-DC-...	24 V DC

MFD-CP8-...	24 V DC
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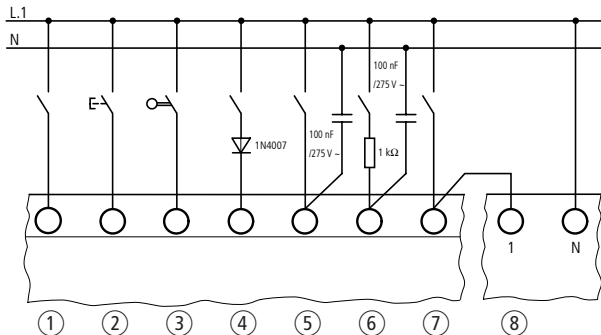
Expansion devices

EASY618-DC-...	24 V DC
EASY620-DC-...	24 V DC

Contactors and Relays

Control relay easy, Multi Function Display MFD-Titan®

Digital input connection of the AC devices



- ① Input signal via relay contact e.g. DILER
- ② Input signal via pushbutton RMQ Titan
- ③ Input signal via position switch e.g. LS Titan
- ④ Conductor length 40 to 100 m for input without additional switching (e.g. easy700 I7, I8 already has addition switching, possible conductor length 100 m)
- ⑤ Increasing the input current
- ⑥ Limiting the input current
- ⑦ Increasing the input current with EASY256-HCI
- ⑧ EASY256-HCI

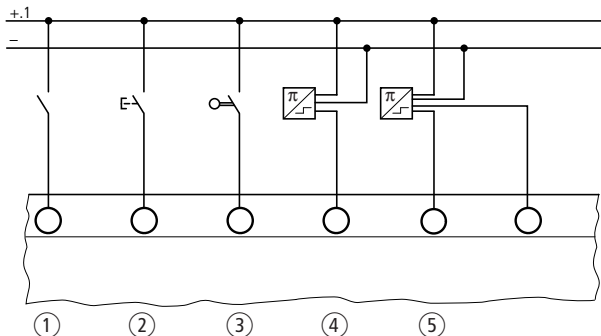
Note

- Due to the input circuitry the drop-out time of the input is increased.
- Length of input conductor without additional switching ≤ 40 m, with additional switching ≤ 100 m.

Contactors and Relays

Control relay easy, Multi Function Display MFD-Titan®

Digital input connection of the DC devices



- ① Input signal via relay contact e.g. DILER
- ② Input signal via pushbutton RMQ Titan
- ③ Input signal via position switch e.g. LS Titan
- ④ Proximity switch, three wire
- ⑤ Proximity switch, four wire

Note

- With conductor length consider also the volt-drop.
- Due to the high residual currents don't use two wire proximity switches.

Contactors and Relays

Control relay easy, Multi Function Display MFD-Titan®

Analogue inputs

Depending upon the device two or three 0 to 10 V inputs are available.

The resolution is 10 Bit = 0 to 1023.

Valid:

I7 = IA01	}	EASY512-AB/DA/DC...	
I8 = IA02			
	}	EASY719/721-AB/DA/DC... EASY819/820/821/822-DC...	
I11 = IA03			
I12 = IA04			MFD-R16, MFD-R17,
			MFD-T16, MFD-TA17

Caution!

Analogue signals are more sensitive to interference than digital signals, therefore the signal cables should be carefully routed and connected. Inappropriate connections can lead to unwanted switching conditions.

- Use screened, twisted pair conductors, to stop interference of the analogue signals.

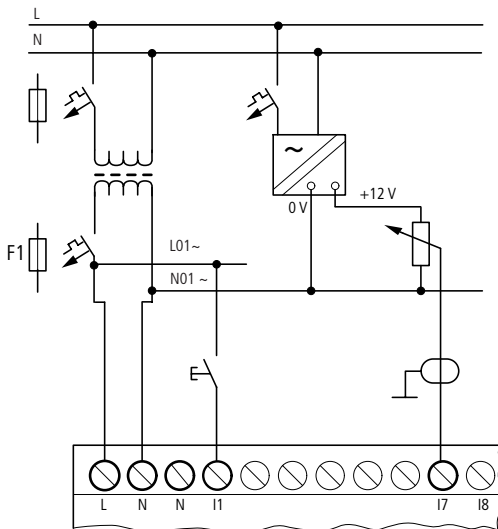
- With short conductor lengths earth the screen on both sides and fully. With a conductor length of approx. 30 m the earthing on both sides can lead to circulating currents between the earthing points and interference of the analogue signals. In this case only earth the conductor on one side.
- Don't lay the signal conductor parallel to the power conductor.
- Inductive loads that must be switched by easy should be connected to a separate power supply or a suppressor circuit should be used for motors and valves. Supplying loads such as motors, magnetic valves or contactors and easy from the same power supply can by switching lead to interference of the analogue input signal.

Contactors and Relays

Control relay easy, Multi Function Display MFD-Titan®

Connection of power supply and analogue inputs for easy..AB device

5



Note

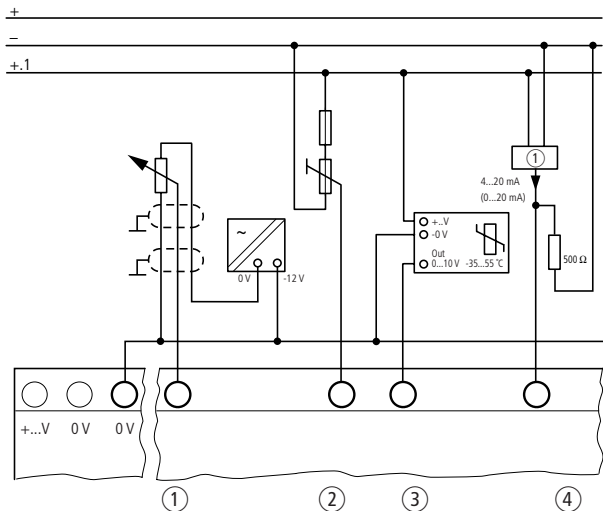
easy..AB devices that process analogue signals must be supplied via a transformer so that there is a galvanic separation from the mains supply. The neutral conductor and the reference potential of DC supplied analogue sensors must be galvanically connected.

Be sure the common reference potential is earthed or monitored by an earth-fault monitoring device. Pay attention to the applicable regulations.

Contactors and Relays

Control relay easy, Multi Function Display MFD-Titan®

Analogue input connections to easy...DA/DC-... or MFD-R.../T...

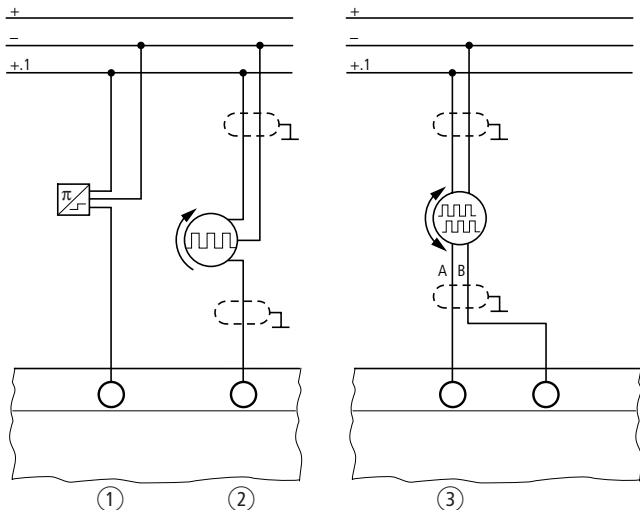


- ① Setpoint device via separate power supply and potentiometer $\leq 1 \text{ k}\Omega$, e.g. $1 \text{ k}\Omega$, 0.25 W
 - ② Setpoint device with upstream resistance $1.3 \text{ k}\Omega$, 0.25 W , potentiometer $1 \text{ k}\Omega$, 0.25 W (value for 24 V DC)
 - ③ Temperature monitoring via temperature sensor and transducer
 - ④ Sensor 4 to 20 mA mit resistor 500Ω
- Note**
- Pay attention to the differing number and designation of the analogue inputs of each device type.
 - Connect the 0 V of the or the MFD-Titan with the 0 V of the power supply of the analogue encoder.
 - sensor of $4(0)$ to 20 mA and a resistance of 500Ω give the following approx. values:
 - $4 \text{ mA} \approx 1.9 \text{ V}$,
 - $10 \text{ mA} \approx 4.8 \text{ V}$,
 - $20 \text{ mA} \approx 9.5 \text{ V}$.
 - Analogue input 0 to 10 V , Resolution 10 Bit , 0 to 1023 .

Contactors and Relays

Control relay easy, Multi Function Display MFD-Titan®

Connection "fast counter", "frequency generator" and "incremental encoder" for easy...DA/DC devices or MFD-R.../T...



- ① Fast counter, square wave signal via proximity switch, pulse pause relationship should be 1:1
 easy500/700 max. 1 kHz
 easy800 max. 5 kHz
 MFD-R/T... max. 3 kHz
- ② Square wave signal via frequency generator, pulse pause relationship should be 1:1
 easy500/700 max. 1 kHz
 easy800 max. 5 kHz
 MFD-R/T... max. 3 kHz

- ③ Square wave signal via incremental encoder
 24 V DC
 easy800DC... and MFD-R/T... max. 3 kHz

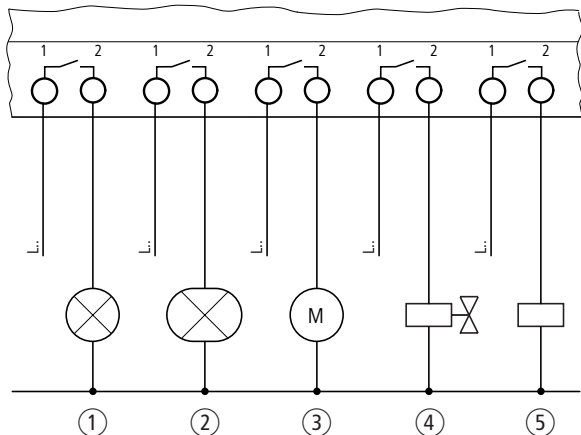
Note

Pay attention to the different number and designation of the inputs of the "fast counter", "frequency generator" and "incremental encoder" for each device type.

Contactors and Relays

Control relay easy, Multi Function Display MFD-Titan®

Connection of relay outputs for easy and MFD-Titan



5

Protection operating potential L..



≅ 8 A/B16

Possible AC voltage range:

24 to 250 V, 50/60 Hz

z. B. L1, L2, L3 phase against neutral

Possible DC voltage range:

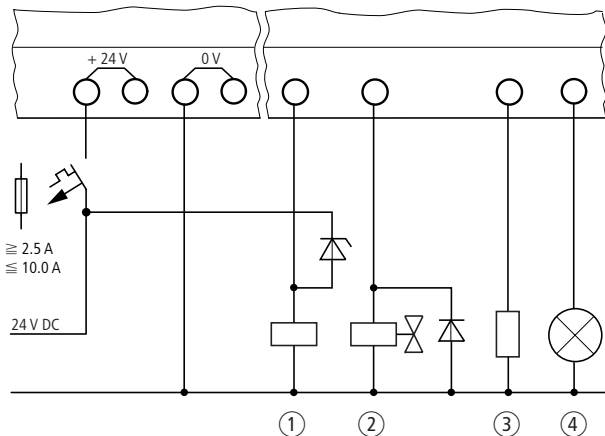
12 to 300 V DC





- ① Lamp, max. 1000 W at 230/240 V AC
- ② Fluorescent tube, max. 10 × 28 W with electronic starter, 1 × 58 W with conventional starter at 230/240 V AC
- ③ AC motor
- ④ Valve
- ⑤ Coil

Contactors and Relays

Control relay easy, Multi Function Display MFD-Titan®

Connection from transistor outputs for easy and MFD-Titan



- ①  Contactor coil with zener diode as suppressor, 0.5 A bei 24 V DC
- ②  Valve with diode as suppressor, 0.5 A at 24 V DC
- ③  Resistor, 0.5 A at 24 V DC
- ④  Indicator lamp 3 or 5 W at 24 V DC, Output dependant upon device types and outputs

Note

When switching off inductive loads the following should be considered:

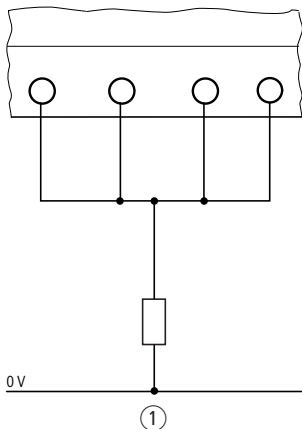
Suppressed inductances cause less interference in the total electrical system. It is generally recommended to connect the suppressor as close as possible to the inductance.

When the inductances are not suppressed, then : several inductances must not be switched off at the same time, so that in the worst case the driver block does not overheat. Should, in an emergency stop situation the +24 V DC supply be switched off by another contact and thereby more than one controlled output be switched off, the inductances must have a suppressor.

Contactors and Relays

Control relay easy, Multi Function Display MFD-Titan®

Parallel switching



① Resistor

Note

The outputs may only be switched parallel within a group (Q1 to Q4 or Q5 to Q8, S1 to S4 or S5 to S8) ; e.g. Q1 and Q3 or Q5, Q7 and Q8. Parallel switched outputs must be simultaneously energised.



when 4 outputs in parallel,
max. 2 A at 24 V DC



when 4 outputs in parallel,
max. 2 A at 24 V DC
Inductance without suppression
max. 16 mH

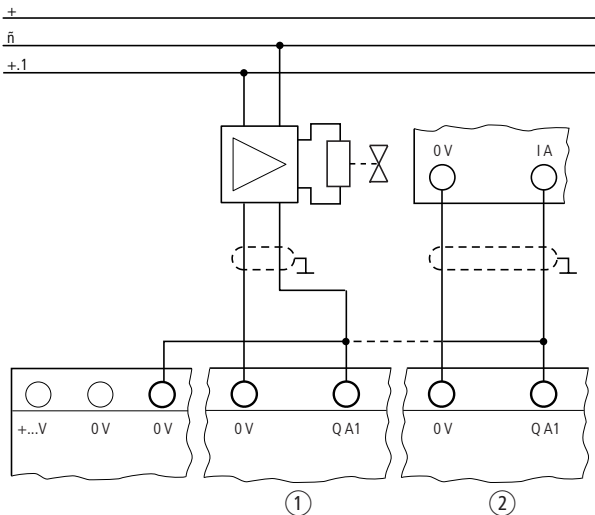


12 or 20 W at 24 V DC
Output dependant upon device types
and outputs

Contactors and Relays

Control relay easy, Multi Function Display MFD-Titan®

Connection of analogue outputs for EASY820-DC-RC..., EASY822-DC-TC..., MFD-RA... and MFD-TA...



- ① Servo valve control
- ② Set value selection for drive control

Note

- Analogue signals are more sensitive to interference than digital signals, therefore the signal conductors should be carefully routed. Inappropriate connections can lead to unwanted switching conditions.
- Analogue output 0 to 10 V, Resolution 10 Bit, 0-1023.

Contactors and Relays

Control relay easy, Multi Function Display MFD-Titan®

Expansion of the input and output points for easy and MFD-Titan

To expand the input and output points there are various solutions :

Central expansion, to 40 I/O

easy700, easy800 and MFD-Titan can be expanded via easy202, easy618 or easy620. Here there are a maximum of 24 inputs and 16 outputs available. An expansion of the basic device is possible.

Decentral expansion, to 40 I/O

easy700, easy800 and MFD-Titan can be expanded via the coupling module easy200-EASY with easy618 or easy620. The expansion device can be operated up to 30 m from the basic device. There are a maximum of 24 inputs and 16 outputs available. An expansion of the basic device is possible.

Networking via EASY-Net, up to 320 I/O

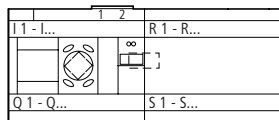
When expanding the inputs and outputs via EASY-Net eight easy800 or MFD-Titan can be connected to each other. Every easy800 or MFD-Titan can be extended with an expansion device. 1 000 m Network length is possible. There are two types of operation:

- One master (position 1, device address 1) plus up to 7 further devices. The programme is in the master.
- One master (position 1, device address 1) plus up to 7 further "intelligent" or "non-intelligent" devices. Every "intelligent" device has a programme.

Contactors and Relays

Control relay easy, Multi Function Display MFD-Titan®

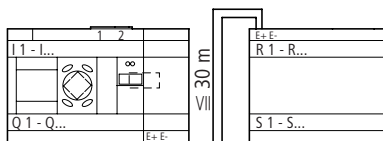
Central and decentral expansion for the basic devices easy700, easy800 and MFD-Titan



easy700... easy618...
 easy800... easy620...
 easy202...

central expansion

5



easy700... easy618...
 easy800... easy200... easy620...

decentral expansion



MFD-AC-CP8... easy618...
 MFD-CP8... easy620...
 easy202...

central expansion



MFD-AC-CP8... easy618...
 MFD-CP8... easy200... easy620...

decentral expansion

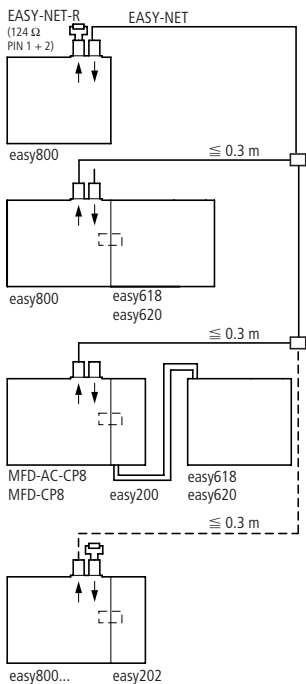
□ □ □ EASY-LINK-DS

For Immediate Delivery call KMParts.com at (866) 595-9616

Contactors and Relays

Control relay easy, Multi Function Display MFD-Titan®

EASY-NET, Network connection "T piece with spur cable"



5

[] EASY-LINK-DS

- Addressing the devices:
 - Single addressing on corresponding device or via EASY-SOFT... on every device.
- The max. total length, including spur cables, with EASY-NET is 1000 m.
- The max. length of T pieces to easy800 or to MFD-Titan is 0,30 m.

Geographic location, position ¹⁾	Device Example 1	Example 2
1	1	1
2	2	3
3	3	8
[8]	(8)	(2)

1) The geographic location/place 1 **always** has the device address 1.

- Should EASY-NET be interrupted between the T piece and the device, or a device is not operational, the network is still active to any further device.
- 4 core cable unscreened, each two cores twisted. Three cores are required. Characteristic impedance of the cable must be 120 Ω.

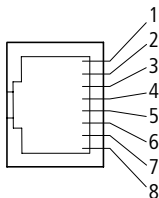
Contactors and Relays

Control relay easy, Multi Function Display MFD-Titan®

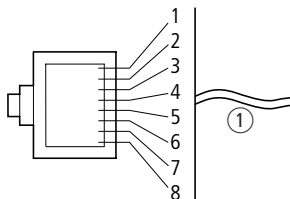
Network connection

Sockets RJ 45 and plug

Connection layout of socket RJ 45 on easy and MFD-Titan.



Connection layout of plug RJ45 on easy and MFD-Titan.



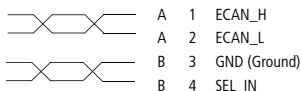
① Cable entry side
8 pole RJ 45, EASY-NT-RJ 45

Layout with EASY-NET

PIN 1; ECAN_H; Data conductor; conductor pair A
PIN 2; ECAN_L; Data conductor; conductor pair A
PIN 3; GND; ground conductor; conductor pair B
PIN 4; SEL_IN; Select conductor; conductor pair B

Configuration of the network cable for EASY-NET

The network cable does not need to be screened. The characteristic impedance of the cable must be 120 Ω.



Note

The minimal operation with easy-NET functions with the conductors ECAN_H, ECAN_L, GND. The SEL_IN conductor is solely for automatic addressing.

Bus terminal resistor

A bus terminal resistor must be connected to the geographical first and last device in the network:

- Value of the bus terminal resistor 124 Ω,
- Connect to PIN 1 and PIN 2 of the RJ-45 plug,
- Connection plug : EASY-NT-R.

Pre-finished conductors, RJ45 plug on both ends

Conductor length [cm]	Part reference
30	EASY-NT-30
80	EASY-NT-80
150	EASY-NT-150

Contactors and Relays

Control relay easy, Multi Function Display MFD-Titan®

Freely useable conductors

100 m $4 \times 0.14 \text{ mm}^2$; twisted in pairs:

EASY-NT-CAB

RJ-45 plug:

EASY-NT-RJ 45

Crimping tool for RJ-45 plug: EASY-RJ45-TOOL.

Calculation of cross section when conductor length is known

The minimum cross section is calculated for the know maximum use of the network.

l = Length of conductor in m

S_{\min} = minimum cross section in mm^2

ρ_{cu} = specific resistance of copper, when nothing else given $0,018 \text{ } \Omega\text{mm}^2/\text{m}$

$$S_{\min} = \frac{l \times \rho_{\text{cu}}}{12.4}$$

Note

When the result of the calculation doesn't give a normal cross section use the next highest normal cross section.

Calculation of conductor length when the cross section is known

For a known conductor cross section the maximum conductor length is calculated.

l_{\max} = Length of conductor in m

S = Conductor cross section in mm^2

ρ_{cu} = specific resistance of copper, when nothing else given $0,018 \text{ } \Omega\text{mm}^2/\text{m}$

$$l_{\max} = \frac{S \times 12.4}{\rho_{\text{cu}}}$$

Contactors and Relays

Control relay easy, Multi Function Display MFD-Titan®

Permissible network length for EASY-NET

Conductor length EASY-NET total m	Transmission speed kBaud	Conductor cross section, standardised		Bus conductor, minimum conductor cross section mm ²
		EN mm ²	AWG	
≤ 6	≤ 1000	0.14	26	0.10
≤ 25	≤ 500	0.14	26	0.10
≤ 40	≤ 250	0.14	26	0.10
≤ 125	≤ 125 ¹⁾	0.25	24	0.18
≤ 175	≤ 50	0.25	23	0.25
≤ 250	≤ 50	0.38	21	0.36
≤ 300	≤ 50	0.50	20	0.44
≤ 400	≤ 20	0.75	19	0.58
≤ 600	≤ 20	1.0	17	0.87
≤ 700	≤ 20	1.5	17	1.02
≤ 1 000	= 10	1.5	15	1.45

1) Default setting

Note

The characteristic impedance of the conductor must be 120 Ω!

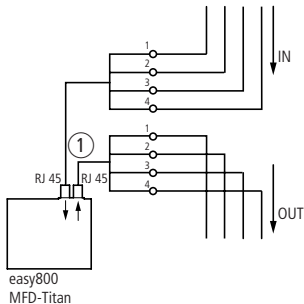
Contactors and Relays

Control relay easy, Multi Function Display MFD-Titan®

Network connection with conductor cross section $> 0.14 \text{ mm}^2$, AWG26

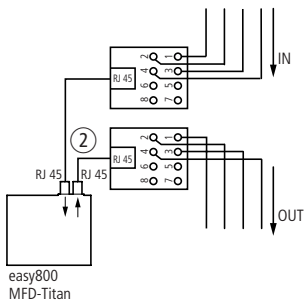
Network connect "through the device".

Example A, with terminals



① Recommendation $\leq 0.3 \text{ m}$

Example B, with interface element

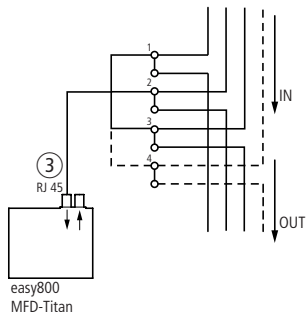


② Recommendation $\leq 0.3 \text{ m}$ (EASY-NT-30)

Network connection with T piece and spur cable

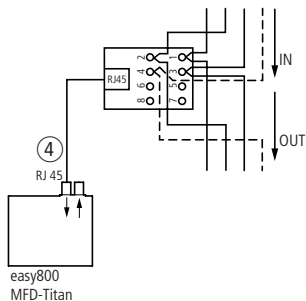
Network connection "T piece with spur cable"

Example A, with terminals



③ $\leq 0.3 \text{ m}$ (3 core)

Example B, with interface element

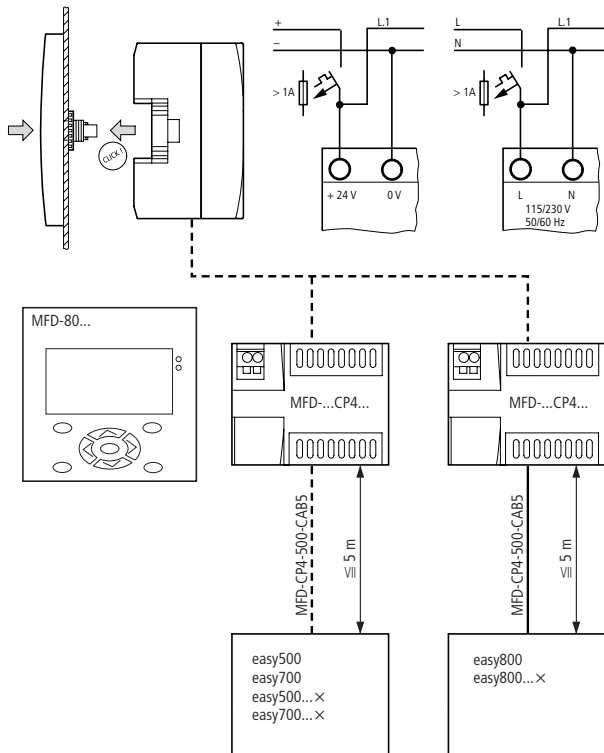


④ $\leq 0.3 \text{ m}$ (EASY-NT-30)

Contactors and Relays

Control relay easy, Multi Function Display MFD-Titan®

Remote display in IP65



On the "remote display" MFD-80... the easy indication display is shown.
The easy can also be operated with the MFD-80-B.

No extra software or programming is necessary to operate the "remote display".
The connection cable MFD-CP4-...-CAB5 can be shortened.

Contactors and Relays

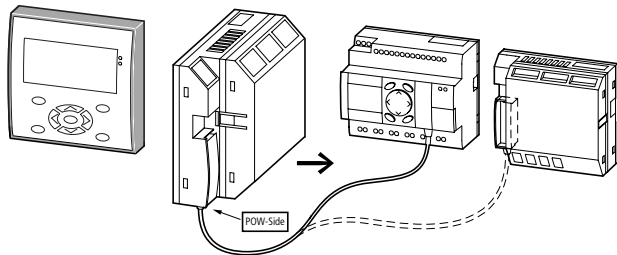
Control relay easy, Multi Function Display MFD-Titan®

COM-LINK connection

MFD-80...

MFD-...-CP8... + MFD..T../R.. easy800

MFD...CP8... + MFD..T../R..



5

The COM-LINK is a point to point connection serial interface. Via this interface the status of the inputs and outputs are read as well as marker areas read and written. Twenty marker double words read or written are possible. Read and written are freely selectable. This data can be used for the set values or display functions.

The devices of the COM-LINK have different functions. The active device is always a MFD...CP8... and controls the complete interface.

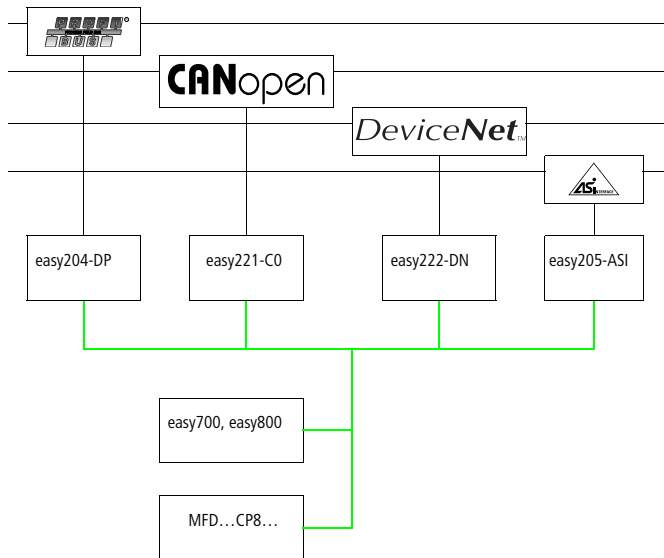
The remote device can be a easy800 or a MFD...CP8... and answers to the requests of the active devices. The remote device doesn't recognise the difference if the COM-LINK is active or a PC with EASY-SOFT-PRO uses the interface. The devices of the COM-LINK can be centralised or decentralised extended with easy expansion devices.

The remote device can also be a device in the EASY-NET.

Contactors and Relays

Control relay easy, Multi Function Display MFD-Titan®

Field bus connection to the production process



network module can be connected with easy700, easy800 or MFD-Titan. The network module is integrated as slave in the configuration.

Expansion of the input and output points via EASY-NET is possible (→ section "EASY-NET, Network connection "through the device"", page 5-31 and → section "EASY-NET, Network connection "T piece with spur cable"", page 5-32).

Further information can be found in the associated manuals:

- AWB2528-1508
easy500, easy700, control relay,
- AWB 2528-1423
easy800, control relay,
- AWB2528-1480D
MFD-Titan, Multi Function Display.

Contactors and Relays

Control relay easy, Multi Function Display MFD-Titan®

Contacts, coils, function modules, operand

Operand	Description	easy500, easy700	easy800, MFD...CP8...
I	Input basic device	×	×
R	Input expansion device ¹⁾	×	×
Q	Output basic device	×	×
S	Output expansion device	×	×
ID	Diagnosis annunciator easy-NET	–	×
M	Marker	×	×
N	Marker	×	–
P	P button	×	×
:	:	×	×
RN	Bit input easy-NET	–	×
SN	Bit output easy-NET	–	×
A	Analogue value comparitor	×	×
AR	Arithmetic	–	×
BC	Block comparison	–	×
BT	Block transfer	–	×
BV	Boolean function	–	×
C	Counting relay	×	×
CF	Frequency counters	× ²⁾	×
CH	High speed counter	× ²⁾	×
CI	Incremental value counter	–	×
CP	Comparitor	–	×
DB	Data module	–	×
D	Text output	×	×
DC	PID controller,	–	×
FT	PT1 Signal smoothing filter	–	×
GT	Draw value out of the easy-NET	–	×
⊙ H/HW	(clock)/Week time clock	×	×
Y/HV	Summer/winter changeover clock	×	×
LS	Value scaling	–	×
Z/MR	Master reset	×	×

5

Contactors and Relays

Control relay easy, Multi Function Display MFD-Titan®

Operand	Description	easy500, easy700	easy800, MFD...CP8...
NC	Number transducer	–	×
O/OT	Hours run counter	×	×
PT	Place value in the easy-NET	–	×
PW	Pulse width modulation	–	×
SC	Synchronise clock via network	–	×
ST	Reference cycle time	–	×
T	Time-delay relay	×	×
VC	Value limiting	–	×
MB	Marker byte	–	×
MD	Marker double word	–	×
MW	Marker word	–	×
I, IA	Analogue input	×	×
QA	Analogue output	–	×

1) With easy700, easy800 and MFD...CP8...




2) With easy500 and easy700 programmable as operation type.

5

Coil functions





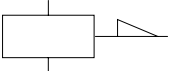

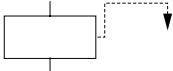

The switching behaviour of the relay coil is determined by the selected coil function. The specified function should for each relay coil only be used once in the wiring diagram.

Not used outputs Q and S can also be used as markers like M and N.

Circuit diagram symbol	easy display	Coil function	Example
	{	Contactor function	{Q1, Q2, {S4, C:1, {M1
	}	Contactor function with inverse result	}Q1, }Q2, }S4
	⌋	Cyclical impulse at negative edge	⌋Q3, ⌋M4, ⌋Q8, ⌋S1

Contactors and Relays

Control relay easy, Multi Function Display MFD-Titan®

Circuit diagram symbol	easy display	Coil function	Example
		Cyclical impulse at positive edge	R04, RM5, R01, RS3
		Surge function	J03, JM4, J08, JS1
		Latch (set)	S08, SM2, S03, SS4
		Reset (reset)	R04, RM5, R01, RS3

5

Parameter sets for times

Example based on EASY-512...

Depending up on the programme the following parameters can be set:

- Switching function,
- Time range,
- Parameter display,
- Time 1 and
- Time 2.

T1	Ω	S	+
I1	30.000		
I2	I1		
□	T:00.000		

T1 Relay No.

I1 Time 1

I2 Time 2

□ Switch state output:

□ Normally open contact open,

■ Normally open contact closed

Ω Switching function

S Time range

+ Parameter display

30.000 constant as value, e. g. 30 s

I7 Variable, e. g. Analogue value I7

T:00.000 clock time

Contactors and Relays

Control relay easy, Multi Function Display MFD-Titan®

Possible coil functions:

- Trigger = TT..
- Reset = RT..
- Halt = HT..

Parameter	Switching function
X	Switching with On-delay
?X	Switching with On-delay and random time range
■	Switching with Off-delay
?■	Switching with Off-delay and random time range
X■	Switching with On-delay and Off-delay
?X■	Switching with On-delay and Off-delay with random time
∩	Switching with single pulse
∥	Switching with flashing

5

Parameter	Time range and set time	Resolution
S 00.000	Seconds: 0.000 to 99,999 s	easy500, easy700 10 ms easy800, MFD...CP8... 5 ms
M:S 00:00	Minutes: Seconds 00:00 to 99:59	1 s
H:M 00:00	Hours: Minutes, 00:00 to 99:59	1 min.

Parameter set	Displaying the parameter set via menu item "Parameter"
+	Can be accessed
-	Cannot be accessed

Contactors and Relays

Control relay easy, Multi Function Display MFD-Titan®

Basic circuits

The easy circuit configuration is input in ladder diagram. This section includes a few circuit examples which are intended to demonstrate the possibilities for your own circuit diagrams.

The values in the logic table have the following meanings for switching contacts:

0 = Normally open contact open, normally closed contact closed

1 = Normally open contact closed, normally closed contact open

For relay coils Qx"

0 = Coil not energized

1 = Coil energized

5

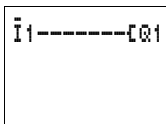
Note

The examples are shown as for easy500 and easy700. For easy800 and MFD...CP8... four contacts and one coils can be used in each path.

Negation

Negation means that the contact opens, rather than closes when actuated (NOT circuit).

In easy circuit example contact I1 changes with the **ALT** button normally closed and normally open contacts.

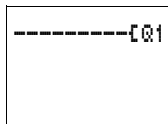


Logic table

I1	Q1
1	0
0	1

Permanent contact

To keep a relay coil permanently energised wire the connection completely across all contact areas from the coil to the left hand side.



Logic table

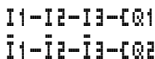
---	Q1
1	1

Contactors and Relays

Control relay easy, Multi Function Display MFD-Titan®

Series circuit

Q1" is actuated via three normally open contacts connected in series (AND circuit).



Q2" is actuated via three normally closed contacts connected in series (NAND circuit).

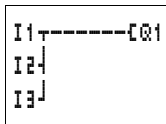
In the easy circuit configuration, up to three normally open or normally closed contacts can be connected in series in one line. Where more than three normally open contacts have to be wired in series, use an auxiliary relay M.

Logic table

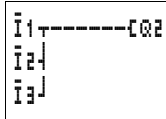
I1	I2	I3	Q1	Q2
0	0	0	0	1
1	0	0	0	0
0	1	0	0	0
1	1	0	0	0
0	0	1	0	0
1	0	1	0	0
0	1	1	0	0
1	1	1	1	0

Parallel switching

Q1 is controlled via a parallel circuit of several normally open contacts (OR circuit).



A parallel circuit of normally closed contacts controls Q2 (NOR circuit).



Logic table

I1	I2	I3	Q1	Q2
0	0	0	0	1
1	0	0	1	1
0	1	0	1	1
1	1	0	1	1
0	0	1	1	1
1	0	1	1	1
0	1	1	1	1
1	1	1	1	0

Contactors and Relays

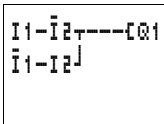
Control relay easy, Multi Function Display MFD-Titan®

Changeover circuit

A changeover circuit is realised in easy with two series circuits that are then combined in parallel (XOR).

XOR means eXclusive OR

circuit. Only when a contact is closed, is the coil energized.



Logic table

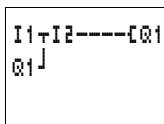
I1	I2	Q1
0	0	0
1	0	1
0	1	1
1	1	0

Hold-on circuit

A combination of series and parallel contacts are wired to a hold-on circuit.

The hold-on (self-maintaining) function is achieved by the Q1 contact being connected in parallel to I1. When I1 is actuated and reopened, the current flows via contact Q1 until I2 is actuated.

S1 normally open contact on I1
S2 normally closed contact on I2



Logic table

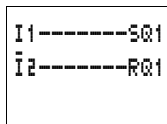
I1	I2	Contact Q1	Coil Q1
0	0	0	0
1	0	0	0
0	1	0	0
1	1	0	1
1	0	1	0
0	1	1	1
1	1	1	1

The hold-on (self-maintaining) circuit is used to switch machines on and off. The machine is switched on at the input terminals via normally open contact S1 and is switched off via normally closed contact S2.

S2 opens the connection to the control voltage in order to switch off the machine. This ensures that the machine can be switched off even in the event of a wire breaking. I2 is always closed when not actuated.

Alternatively a hold-on circuit with wire break monitoring can be used with the set and reset coil functions.

S1 normally open contact on I1
S2 normally closed contact on I2



Contactors and Relays

Control relay easy, Multi Function Display MFD-Titan®

When I1 is switched, coil Q1 latches. I2 inverts the normally closed signal from S2 and switches when S2 is actuated and the machine must be switched off or when there is a broken wire.

Keep to the order that each coil is wired in the easy circuit diagram: first wire the "S"-coil, and then the "R"-coil. When I2 is actuated, the machine will then be switched off even if I1 is switched on again.

On-delayed timing relay

The on-delay can be used to override a short impulse or with a machine, to start a further operation after a time delay.

S1 normally open contact on I1



Impulse changeover relay

An impulse changeover relay is often used for lighting control e.g. stairway lighting.

S1 normally open contact on I1



Logic table

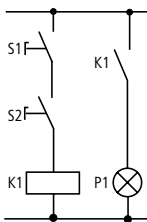
I1	Status of Q1	Q1
0	0	0
1	0	1
0	1	1
1	1	0

Contactors and Relays

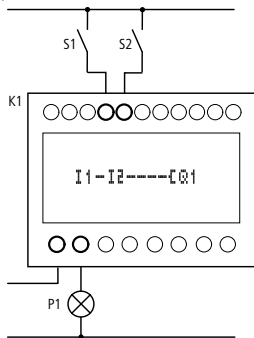
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Wiring of contacts and relays

Fixed wiring



Wired with easy

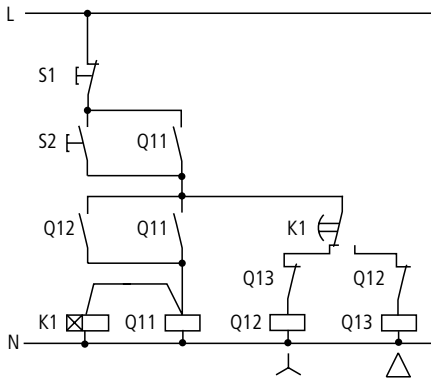


5

Star-delta starting

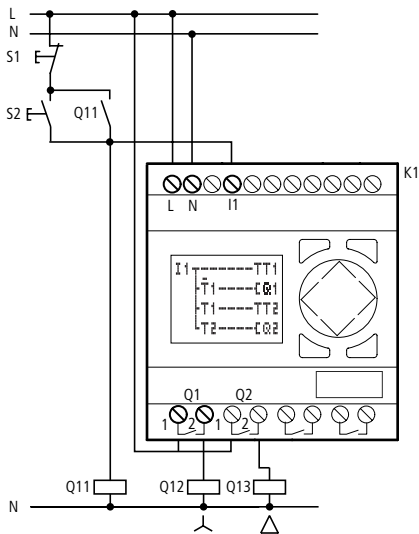
With easy it is possible to implement two star/delta circuits. The advantage of easy is that it is possible to select the changeover time between

star and delta contactors, and also the time delay between switching off the star contactor and switching on the delta contactor.



Contactors and Relays

Control relay easy, Multi Function Display MFD-Titan®



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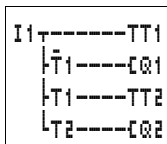
Operation of the easy circuit configuration

Start/stop the circuit with the external pushbuttons S1 and S2. The mains protection starts the time relay in easy.

I1: Mains protection switched on

Q1: Star contactor ON

Q2: Delta contactor ON



T1: Changeover time star/delta (10 to 30 s)

T2: Waiting time between starcontactor off and delta contactor on (30, 40, 50, 60 ms)

If your easy has an integral time switch, star/delta starting can be combined with the time switch. In this case, use easy to also switch the mains contactor.

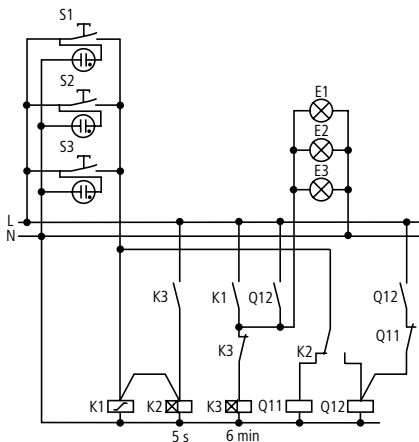
Contactors and Relays

Control relay easy, Multi Function Display MFD-Titan®

Stairway lighting

For a conventional circuit a minimum of five elements are required. An impulse relay, two timing relays, two auxiliary relays.

easy needs only four elements. With five connections and the easy circuit the stairway lighting is operational.

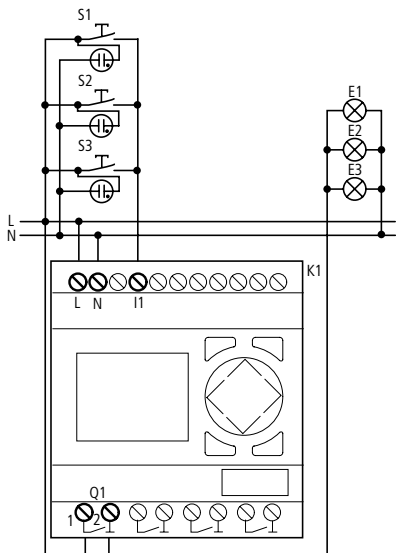


Important note

Four such stairway circuits can be implemented with one easy device.

Contactors and Relays

Control relay easy, Multi Function Display MFD-Titan®



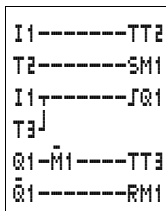
5

Button pressed briefly	Light On or Off, the impulse changeover relay function is able to switch off continuous lighting where required.
Light Off after 6 min.	Switched off automatically. With continuous lighting this function is not active.
Button pressed for longer than 5 s	Continuous lighting

Contactors and Relays

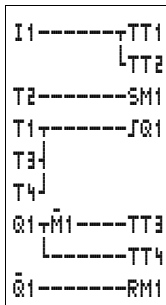
Control relay easy, Multi Function Display MFD-Titan®

The easy circuit configuration for the function below looks like this:



5

Expanded easy circuit configuration: after four hours, the continuous lighting is switched off.



Meaning of the contacts and relays used:

I1: Pushbutton ON/OFF

Q1: Output relay for lighting ON/OFF

M1: Auxiliary relay used to block the "switch off automatically after 6 minutes" when using continuous lighting.

T1: Cyclical impulse for switching Q1 ON/OFF, (I, impulse with value 00.00 s)

T2: Scan to determine how long the pushbutton was pressed. When pressed for longer than 5 s, it changes to continuous lighting. (X, On-delayed, value 5 s)

T3: Switch off after the light has been on for von 6 min. (X, on-delayed, value 6:00 min.)

T4: Switch off after 4 hours continuously on. (X, On-delayed, value 4:00 h)

Contactors and Relays

Control relay easy, Multi Function Display MFD-Titan®

4 way shift register

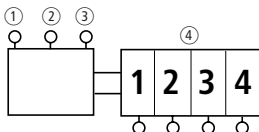
A shift register can be used for storing an item of information – e.g. sorting of items into “good” or “bad” – two, three or four transport steps further on.

A shift pulse and the value (0” or 1”) to be shifted are required for the shift register.

Values which are no longer required are deleted via the reset input of the shift register. The values in the shift register pass through the register in the following order:

1st, 2nd, 3rd, 4th storage position.

Block diagram of the 4-way shift register



- ① Pulse
- ② Value
- ③ Reset
- ④ Storage position

Function:

Pulse	Value	Storage position			
		1	2	3	4
1	1	1	0	0	0
2	0	0	1	0	0
3	0	0	0	1	0
4	1	1	0	0	1
5	0	0	1	0	0
Reset = 1		0	0	0	0

Allocate the value 0 with the information content bad. Should the shift register be accidentally deleted, no bad parts will be reused.

I1: Shift clock pulse (PULSE)

I2: Information (good/bad) for shifting (VALUE)

I3: Delete contents of shift register (RESET)

M1:1. memory position

M1:2. memory position

M1:3. memory position

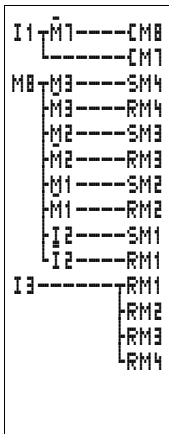
M1:4. memory position

M7:Auxiliary relay one shot cycle pulse

M8:One shot cycle pulse clock pulse

Contactors and Relays

Control relay easy, Multi Function Display MFD-Titan®



Generate shift tact

4th memory position, set
 4th memory position, delete
 3rd memory position, set
 3rd memory position, delete
 2nd memory position, set
 2nd memory position, delete
 1st memory position, set
 1st memory position, delete
 Delete all memory positions

5

Contactors and Relays

Control relay easy, Multi Function Display MFD-Titan®

Display text and actual values , display and edit set values

easy500 and easy700 can display 16, easy800 can display 32 freely editable texts. In these texts actual values of function relays such as, timer relays, counters, hours run counters, analog value comparitors, dates, times or analog values can be displayed. Set values of timer relays, counters, hours run counters and analog value comparitors can be altered during the display of the texts.

```
SWITCHING,
CONTROL,
DISPLAY,
ALL EASY!
```

Example of a text display:

The text display has the following display characteristics:

RUN TIME M:S	— Line 1, 12 characters
T1 :012:46	— Line 2, 12 characters, one actual value or set value
C1 :0355 ST	— Line 3, 12 characters, one actual value or set value
PRODUCED	— Line 4, 12 characters

The text output unit D (D = Display,) functions in the circuit diagram like a normal marker M.

Should a text be attached to a marker this would be shown at condition 1 of the coil in the easy display. A precondition is that the easy is in RUN mode and before the texts are displayed the status display is shown.

D1 is defined as alarm text and has therefore priority over other displays.

D2 to D16/D32 are displayed when activated.

When several displays are activated they are shown one after the other every 4 secs. When a set value is edited the corresponding display remains shown until the value transfer.

In one text several values, actual and set values, from for example, function relays, analog input values or times and dates can be combined. The set values can be edited:

- easy500 and easy700, two values,
- easy800, four values.

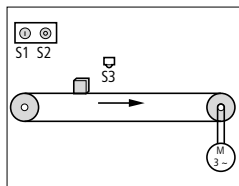
Contactors and Relays

Control relay easy, Multi Function Display MFD-Titan®

Visualisation with MFD Titan

The visualisation with MFD-Titan is by "screens", on which the display is shown.

Example of a "screen":



5

The following screen elements can be combined.

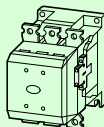
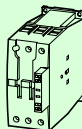
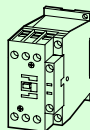
- Graphic elements
 - Bit display
 - Bitmap
 - Bargraph
- Pushbutton elements
 - Latching pushbuttons
 - Pushbutton area
- Text elements
 - Static text
 - Message text
 - Screen menu
 - Ticker text
 - Rolling text
- Value display elements
 - Date and time displays
 - Number values
 - Timer relay value display
- Value input elements
 - Value inputs
 - Timer relay value inputs
 - Date and time inputs
 - Weekly timer inputs
 - Yearly timer inputs

Notes

Contactors and Relays

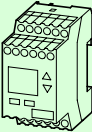
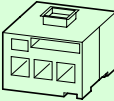
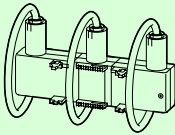
Contactors DIL, Motor overload relays Z

Rated operational current I_e at 400 V	Max. AC-3 motor rating				Conv. therm. current $I_{th} = I_e$ AC-1	Part no.
	220 V, 230 V	380 V, 400 V	660 V, 690 V	1000 V		
A	kW	KW	kW	kW	A	
6.6	1.5	3	3	–	22	DILEEM
8.8	2.2	4	4	–	22	DILEM
7	2.2	3	3.5	–	22	DILM7
9	2.5	4	4.5	–	22	DILM9
12	3.5	5.5	6.5	–	22	DILM12
17	5	7.5	11	–	40	DILM17
25	7.5	11	14	–	45	DILM25
32	10	15	17	–	45	DILM32
40	12.5	18.5	23	–	60	DILM40
50	15.5	22	30	–	70	DILM50
65	20	30	35	–	85	DILM65
80	25	37	63	–	130	DILM80
95	30	45	75	–	130	DILM95
115	37	55	105	–	190	DILM115
150	48	75	125	–	190	DILM150
185	55	90	175	108	275	DILM185
225	70	110	215	108	315	DILM225
250	75	132	240	108	350	DILM250
300	90	160	286	132	400	DILM300
400	125	200	344	132	500	DILM400
500	155	250	344	132	700	DILM500
580	185	315	560	600	800	DILM580
650	205	355	630	600	850	DILM650
750	240	400	720	800	900	DILM750
820	260	450	750	800	1000	DILM820
1000	315	560	1000	1000	1000	DILM1000



Contactors and Relays

Contactors DIL, Motor overload relays Z

Part no.	Auxiliary contact blocks		Motor overload relay	Electronic motor protection system ZEV		
	For top mounting	For side mounting				
DILEEM DILEM	02DILEM 11DILEM 22DILEM	–	ZE-0,16 to ZE-9			
DILM7 DILM9 DILM12 DILM17 DILM25 DILM32	DILA-XHI(V) ... DILM32-XHI ...	–	ZB12-0,16 to ZB12-12			
			ZB32-0,16 to ZB32-32			
DILM40 DILM50 DILM65 DILM80 DILM95 DILM115 DILM150	DILM150XHI(V)...	DILM1000-XHI(V) ...	ZB65-10 to ZB65-65		ZEV + ZEV-XSW-25 ZEV-XSW-65 ZEV-XSW-145 ZEV-XSW-820 	
			ZB150-35 to ZB150-150			
DILM185 DILM225 DILM250 DILM300 DILM400 DILM500 DILM580 DILM650 DILM750 DILM820 DILM1000	–	DILM1000-XHI...	Z5-70/FF250 to Z5-250/FF250			
			ZW7-63 to ZW7-630			
			–			

Contactors and Relays

Contactors DIL

Accessories

Unit	DILE(E)M	DIL7 to DILM150		DILM185 to DILM500	DILM580 to DILM1000
		AC	DC		
Suppressor circuits	–	–	integrated	integrated	integrated
RC suppressors	X	X			
Varistor suppressors	X	X			
Star-point bridge	X	X	X	X	–
Parallel connector	X	X	X	to DILM185	–
Mechanical inter-lock	X	X	X	X	X
Sealable shroud	X	–	–	–	–
Cable terminals	–	–	–	X	to DILM820
Individual coils	–	X ¹⁾	X ¹⁾	X	X
Electronic modules	–	–	–	X	X
Electronic modules including coils	–	–	–	X	X
Terminal cover	–	–	–	X	X

1) from DILM17

Contactors and Relays

Contactors DIL

Contactors DILM

These are designed and tested to IEC/EN 60 947. For every motor rating between 3 kW and 560 kW there is a suitable contactor available.

Equipment features

- Magnet system
Due to the new electronic operation the DC contactors from 17 to 65 A have a sealing power of only 0.5 W. Even for 150 A is only 1.5 W necessary.
- Accessible control voltage connections
The coil connections are on the front of the contactor. They are not covered by the main current wiring.
- Can be controlled directly from the PLC
The contactors DILA and DILM to 32 A can be controlled directly from the PLC.
- Integrated suppressor DC
With all DC contactors DILM a suppressor is integrated in the electronics.
- Plug-in suppressors AC
With all AC contactors DILM up to 150 A a suppressor can be simply plugged in on the front when required.
- Control of the contactors DILM185 to DILM1000 by three different methods:
 - Conventionally via coil terminals A1-A2
 - Directly from a PLC via terminals A3-A4
 - by a low power contact via terminals A10-A11.
- Conventional control of contactors DILM185-S to DILM500-S via coil terminals A1-A2.
There are two coil versions (110 to 120 V 50/60 Hz and 220 to 240 V 50/60 Hz) available.
- All contactors up to DIL150 are finger and back-of-hand proof to IEC 536. Additional terminal covers are available from DILM185 onwards.
- Double-frame terminal for contactors DILM7 to DILM150
With the new double frame-clamp the connection area is not limited by the screw. They give total security with varying cross sections and have protection against incorrect insertion to ensure safe connection.
- Integrated auxiliary contact
The contactors up to DILM32 have an integrated auxiliary contact as normally open or normally closed contact.
- Screw or spring terminals
The contactors DILE(E)M and DILA/DILM12, including the corresponding auxiliary contacts, up to 1000 A, are available with screw or spring terminals.
- Contactors with screwless terminals
They have spring terminals in the mains current circuit as well as for the coil terminals and auxiliary contacts. The shake proof and maintenance free spring terminals can terminate two conductors each of 0.75 to 2.5 mm² with or without ferrules.
- Connection terminals
Up to DILM65 the connection terminals for all auxiliary contacts and coils as well as for main conductors can be tightened with a Pozidriv screwdriver size 2.
For contactors DILM80 to DILM150 Allen screws are used.
- Mounting
All contactors can be fitted on to a mounting plate with fixing screws. DILE(E)M and DILM up to 65 A can also be snapped on to a 35 mm top-hat rail to IEC/EN 60715.
- Mechanical interlock
With two connectors and a mechanical interlock an interlocked contactor combination up to 150 A can be achieved without extra space requirement. The mechanical interlock ensures that both connected contactors cannot be simultaneously operated. Even with a mechanical shock the contacts of both contactors cannot close simultaneously.

Contactors and Relays

Contactors DIL

In addition to individual contactors, complete contactor combinations are also available from Moeller:

- DIUL reversing contactors from 3 to 75 kW/400 V
- SDAINL star-delta starters from 5.5 to 132 kW/400 V

Application

The three-phase motor dominates the electric motor sector. Apart from individual low-power drives, which are often switched directly by hand, most motors are controlled using contactors and contactor combinations. The power rating in kilowatts (kW) or the current rating in amperes (A) is therefore the critical feature for correct contactor selection.

Physical motor design results in that rated currents for the same rating sometimes differ widely. Furthermore it determines the ratio of the transient peak current and the locked-rotor current to the rated operational current (I_e). Switching electrical heating installations, lighting fittings, transformers and power factor correction installations, with their typical individual characteristics, increases the wide range of different uses for contactors.

The switching frequency can vary greatly in every application. The difference can be, for example, from less than one operation per day up to a thousand operations or more per hour. Quite often, in the case of motors, a high switching frequency coincides with inching and plugging duty.

Contactors are actuated by hand or automatically, using various types of command devices, depending on the travel, time, pressure or temperature. Any interrelationships required between a number of contactors can easily be produced by means of interlocks via their auxiliary contacts.

The auxiliary contact of the contactor DILNM can be used as mirror contact to IEC/EN 60947-4-1 Appendix F to show the condition of the main contacts. A mirror contact is a normally closed contact that cannot be simultaneously closed with the normally open main contacts.

Contactors and Relays

Contactors DIL

Contactor DILP

DILP contactors are used for problem-free switching of supply systems including the neutral pole or for economical switching of resistive loads. In three-phase distribution systems, mainly 3 pole switchgear and protective devices are used. 4 pole switchgear and protective devices are used in

order to switch the neutral pole as well in special applications.

In the area of 4 pole applications, there are national differences concerning the Standards situation, the customary distribution system and conventions that go beyond the Standards.

Rating data

max. rated operational current I_e

AC-1 open			conv. therm. current	Part no.
40 °C	50 °C	70 °C	$I_{th} = I_e$ AC-1 open	
160 A	160 A	155 A	160 A	DILP160/22
250 A	230 A	200 A	250 A	DILP250/22
315 A	270 A	215 A	315 A	DILP315/22
500 A	470 A	400 A	500 A	DILP500/22
630 A	470 A	400 A	630 A	DILP630/22
800 A	650 A	575 A	800 A	DILP800/22

Contactors and Relays

Overload relays Z

Motor protection using Z thermal overload relays

Overload relays are included in the group of current-dependent protective devices. They monitor the temperature of the motor winding indirectly via the current flowing in the supply cables, and offer proven and cost-efficient protection from destruction as a result of:

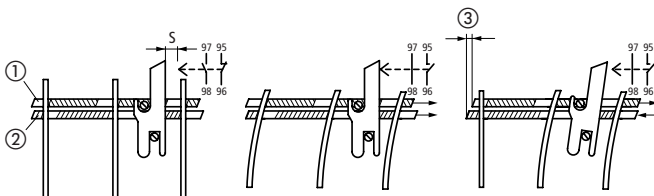
- Non starting,
- Overload,
- Phase-failure.

Overload relays operate by using the characteristic changes of shape and state of the bimetal when subjected to heating. When a specific temperature is reached, they operate an auxiliary contact. The heating is caused by resistances through which the motor current flows. The equilibrium between the reference and actual value occurs at various temperatures depending on the magnitude of the current.

Tripping occurs when the reference temperature is reached. The tripping delay depends on the magnitude of the current and preloading of the relay. Whatever the current, the relay must trip out before the motor insulation is endangered, which is why EN 60947 states maximum response times. To prevent nuisance tripping, minimum times are also given for the limit current and locked-rotor current.

Phase-failure sensitivity

Overload relays Z offer, due to their design, an effective protection against phase failure. They have phase failure sensitivity to IEC 947-4-1 and therefore can also provide protection for EEx e motors (→ following diagrams).



Normal operation (no fault)

① Trip bridge

② Differential bar

③ Differential travel

Three phase overload

One phase drops out

Contactors and Relays

Overload relays Z

When the bimetallic strips in the main current section of the relay deflect as a result of three-phase motor overloading, all three act on a trip bar and a differential bar. A shared trip lever switches over the auxiliary contact when the limits are reached. The trip and differential bars lie against the bimetallic strips with uniform pressure. If, in the event of phase failure for instance, one bimetallic strip does not deflect (or recover) as strongly as the other two, then the trip and differential bars will cover different distances.

This differential movement is converted in the device by a step-up mechanism into a supplementary tripping movement, and thus accelerates the tripping action.

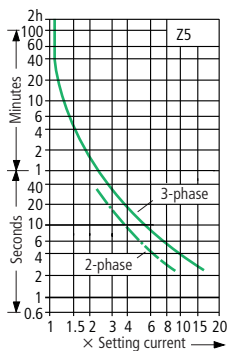
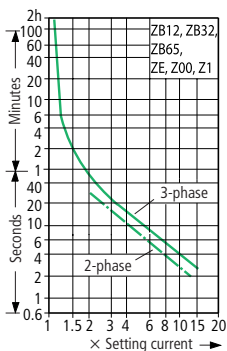
Design note → section "Motor protection in special applications", page 8-7;
Further information to motor protection → section "All about Motors", page 8-1.

Tripping characteristics

The overload relays ZE, ZB12, ZB32 and the Z5 up to 150 A are, due to the German Physical/Technical Bureau (PTB), suitable for protection of EEx e-motors to the ATEX-Guidelines 94/9 EG. In the relevant manual all tripping characteristics are printed for all currents.

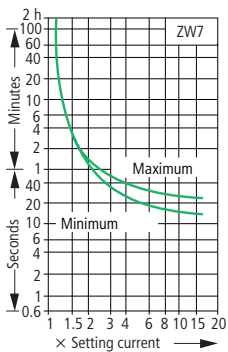
These tripping characteristics are mean values of the scatter bands at an ambient temperature of 20 °C from cold. The tripping time is dependant upon the current. When units are warm, the tripping delay of the overload relay drops to about a quarter of the value shown.

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Contactors and Relays

Overload relays Z



Contactors and Relays

ZEV electronic motor-protective system

Method of operation and control

Like overload relays operating on the bimetallic strip principle, electronic motor-protective relays are current-dependent protective devices.

The acquisition of the actual flowing motor current in the three external conductors of the motor connections is with motor protection system ZEV with separate push-through sensors or a sensor belt. These are combined with an evaluation unit so that separate arrangement of the current sensor and the evaluation unit is possible.

The current sensor is based on the Rogowski principle from the measurement technology. The sensor belt has no iron core, unlike a current transformer, therefore it doesn't become saturated and can measure a very wide current range.

Due to this inductive current detection, the conductor cross-sections used in the load circuit have no influence on the tripping accuracy. With electronic motor-protective relays, it is possible to set higher current ranges than is possible with electromechanical thermal overload relays. In the ZEV System, the entire protected range from 1 to 820 A is covered using only an evaluator.

The ZEV electronic motor-protective system carries out motor protection both by means of indirect temperature measurement via the current and also by means of direct temperature measurement in motors with thermistors.

Indirectly, the motor is monitored for overload, phase failure and unbalanced current consumption.

With direct measurement, the temperature in the motor winding is detected by means of one or more PTC thermistors. In the event of excessive temperature rise, the signal is passed to the tripping unit and the auxiliary contacts are actuated. A reset is not possible until the thermistors cool to less than the response temperature. The built-in thermistor connection allows the relay to be used as complete motor protection.

In addition, the relay protects the motor against earth faults. Small currents flow out even in the event of minor damage to the motor winding insulation. These earth fault currents are registered on an external summation current transformer which adds together the currents in the phases, evaluates them and reports earth-fault currents to the microprocessor in the relay.

By selecting one of the eight tripping classes (CLASS) allows the motor to be protected to be adapted from normal to extended starting conditions. This allows the thermal reserves of the motor to be used safely.

The motor-protective relay is supplied with an auxiliary voltage. The evaluator has a multi-voltage version, which enables all voltages between 24 V and 240 V AC or DC to be applied as supply voltage. The devices have monostable behaviour; they trip out as soon as the supply voltage fails.

Contactors and Relays

ZEV electronic motor-protective system

In addition to the usual normally closed contact (95-96) and the normally open contact (97-98) for overload relays the motor protection relay ZEV is equipped with a programmable normally open contact (07-08) and a programmable normally closed contact (05-06). The above mentioned, usual contacts react directly via thermistors or indirectly via the current, to the detected temperature rise of the motor, including phase-failure sensitivity.

The programmable contacts can be assigned to various signals, such as

- Earth-fault,
- Pre-warning at 105 % thermal overload,
- separate indication of thermistor tripping
- internal device fault

The function assignment is menu-guided using a display. The motor current is entered without tools using the keypad, and can be clearly verified on the display.

In addition the display allows a differential diagnosis of tripping causes, and therefore a faster error handling is possible.

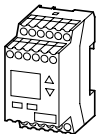
Tripping in the event of a three-pole balanced overload at x-times the set current takes place within the time specified by the tripping class. The tripping delay in comparison with the cold state is reduced as a function of the preloading of the motor. Very good tripping accuracy is achieved and the tripping delays are constant over the entire setting range.

If the motor current imbalance exceeds 50 %, the relay trips after 2.5 s.

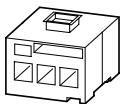
The accreditation exists for overload protection of explosion proof motors of the explosion protection "increased safety" EEx e to guideline 94/9/EG as well as the report of the German Physical/Technical Bureau (PTB report) (EG-Prototype test certificate number PTB 01 ATEX 3233). Further information can be found in the manual AWB2300-1433D "Motor protection system ZEV, overload monitoring of motors in EEx e areas".

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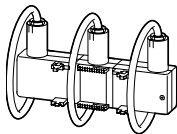
Electronic motor protection system ZEV



Evaluation device
1 to 820 A



Push-through sensor
1 to 25 A
3 to 65 A
10 to 145 A

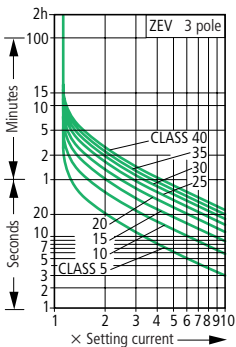


Sensor belt
40 to 820 A

Contactors and Relays

ZEV electronic motor-protective system

Tripping characteristics



Tripping characteristics for 3 phase loads

These tripping characteristics show the relationship between the tripping time from cold to the current (multiples of set current I_E). After preloading with 100 % of the set current and the temperature rise to the operational warm state associated with it, the stated tripping delays are reduced to approx. 15 %.

Tripping limits for 3 pole balanced load

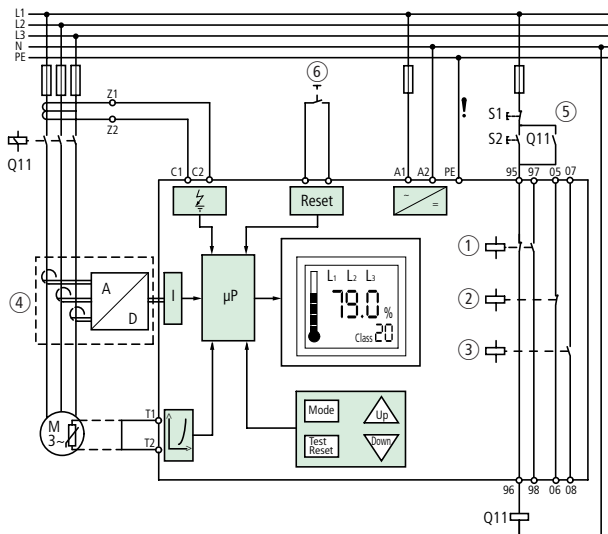
Response time

- < 30 min. at up to 115 % of the set current
- > 2 h at up to 105 % of the set current

Contactors and Relays

ZEV electronic motor-protective system

Electronic motor protection system ZEV with earth-fault monitoring and thermistor monitored motor



- ① Fault
- ② Programmable contact 1
- ③ Programmable contact 2
- ④ Current sensor with A/D transducer
- ⑤ Self hold-in of the contactor prevents an automatic re-start after the control voltage has failed and then returned (important for EEx e applications, → AWB2300-1433D)
- ⑥ Remote reset

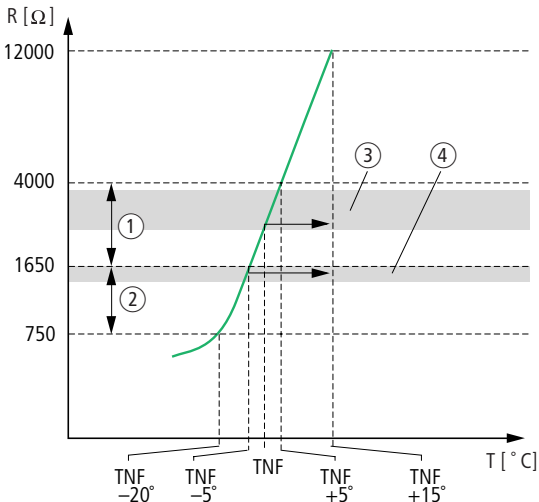
Contactors and Relays

ZEV electronic motor-protective system

Thermistor protection

With thermistor motor protection, to DIN 44081 and DIN 44082, up to six PTC thermistor

temperature sensors with a thermistor resistance of $R_K \leq 250 \Omega$ or nine with a $R_K \leq 100 \Omega$ can be connected to terminals T1-T2.



TNF= Nominal response temperature

- ① Tripping range IEC 60947-8
- ② Re-switch on range IEC 60947-8
- ③ Tripping at $3200 \Omega \pm 15 \%$
- ④ Re-switch on at $1500 \Omega \pm 10 \%$

The ZEV switches off at $R = 3200 \Omega \pm 15 \%$ and switches on again at $R = 1500 \Omega \pm 10 \%$. With switch off due to thermistor

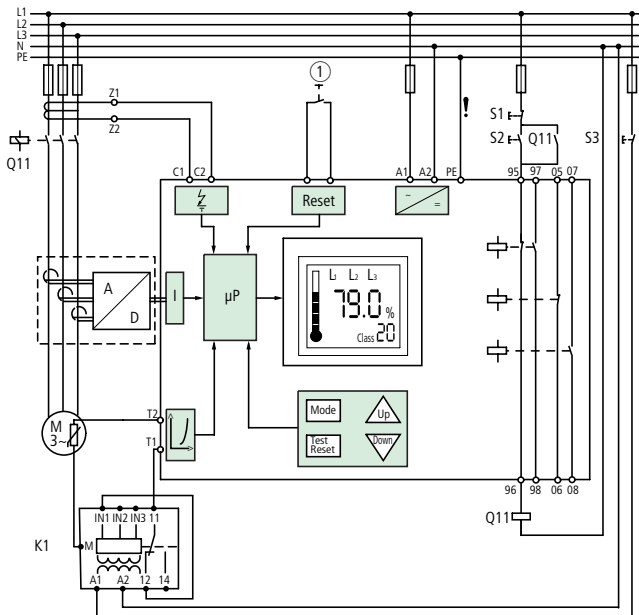
input the contacts 95-96 and 97-98 switch over. Additionally, the thermistor trip can be programmed to different trip messages on contacts 05-06 or 07-08.

With temperature monitoring with thermistors, no dangerous condition can occur should a sensor fail as the device would directly switch off.

Contactors and Relays

ZEV electronic motor-protective system

Electronic motor protection system ZEV with short-circuit monitoring at the thermistor input



Short-circuit in the thermistor circuit can, when required, be detected by the additional use of a current monitor K1 (e. g. type EIL 230 V AC from the company Cronzet or the similar type 3U6352-1-1AL20 from the company Siemens).

Basic data

- Short-circuit current in the sensor circuit \cong 2.5 mA,
- max. cable length to sensor 250 m (unscreened),

- Total PTC thermistor sensor resistance \cong 1500 Ω
- Programming ZEV: "Auto reset",
- Setting current monitor:
 - Device to lowest current level,
 - Overload tripping,
 - Store the tripping,
- Confirmation of the short-circuit after clearing with pushbutton S3.

Contactors and Relays

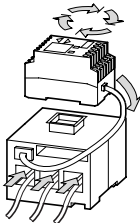
ZEV electronic motor-protective system

Device mounting

The mounting of the device is very simple due to the clip-on and the push-through mounting.

Mounting details of every device can be found in the mounting instructions AWA2300-1694 or the manual AWB2300-1433D.

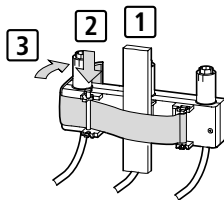
Mounting ZEV and current sensor



- Place the ZEV in the desired mounting position.
- Click the ZEV on the current sensor.
- Position motor conductors through the current sensor.

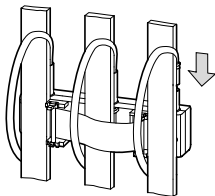
Mounting on the current conductors

Due to the fixing band the Rogowski sensor ZEV-XSW-820 is particularly easy to mount. And this saves the user time and money.



- 1 Wrap the band around the current conductors.
- 2 Engage the fixing pin.
- 3 Pull the fixing band tight and close with the velcro fastener.

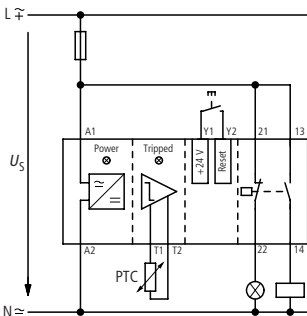
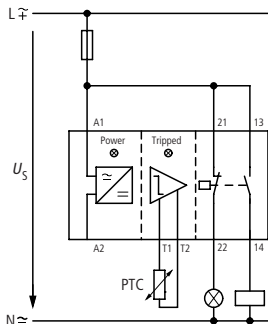
Attaching the sensor coils → following diagram.



Contactors and Relays

Thermistor machine protection device EMT6

EMT6 for PTC thermistors



Method of operation

The output relay is actuated when the control voltage is switched on and the resistance of the PTC thermistor temperature sensor is low. The auxiliary contacts operate. On reaching the nominal actuation temperature (NAT), the sensor resistance becomes high and causes the output relay to drop out. The defect is indicated by an

LED. As soon as the sensors have cooled enough so that the respective smaller resistance is reached the EMT6-(K) switches automatically on again. With the EMT6-(K)DB(K) the automatic re-switch on can be defeated by switching the device to "Hand". The unit is reset using the reset button. The EMT6-K(DB) and EMT6-DBK are fitted with a short-circuit in sensor circuit monitor. Should the resistance in the sensor circuit fall below 20 Ohm it trips. The EMT6-DBK also has a zero voltage safe, re-switch on lock-out and stores the fault by a loss of voltage. Switching on again is possible only after the fault has been rectified and the control voltage is present again.

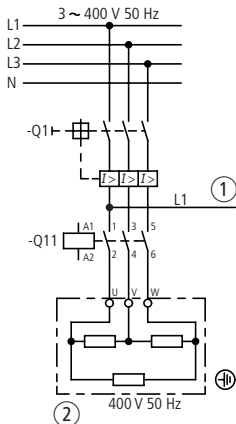
Since all the units use the closed-circuit principle, they also respond to a broken wire in the sensor circuit.

The thermistor machine protection relays EMT6... are accredited for protection of EEx e motors to ATEX-Guideline 94/9 EG by the German Physical/Technical Bureaux. For protection of EEx e motors the ATEX Guidelines require short-circuit monitoring in the sensor circuit. Because of their integrated short-circuit monitoring the EMT6-K(DB) and EMT6-DBK are especially suitable for this application.

Contactors and Relays

Thermistor machine protection device EMT6

EMT6 as contact protection relay



Application example

Control of a storage tank heater

① Control circuit

② Heater

Q11: Heater protection

5

Description of operation

Switching on the heater

The heater can be switched on provided the main switch Q1 is switched on, the safety thermostat F4 has not tripped and the condition $T \leq T_{min}$ is satisfied. When S1 is actuated, the control voltage is applied to the contactor relay K1, which maintains itself via a make contact. The changeover contact of the contact thermometer has the position I-II. The low resistance sensor circuit of the EMT6 guarantees that Q11 is actuated via K2 normally open contact 13-14; Q11 goes to self-maintain.

Switching off the heater

The heater protection Q11 stays in self maintain until the main switch Q1 is switched off, the pushbutton S0 is pressed, the thermostat trips or $T = T_{max}$.

When $T = T_{max}$ the changeover contact of the contact thermometer has the position I-III. The sensor circuit of the EMT6 (K3) is low resistance, the normally closed contact K3/21-22 open. The main protection Q11 drops out.

Contactors and Relays

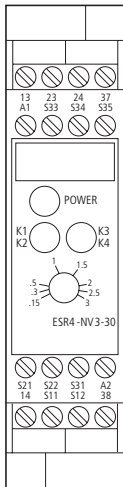
Electronic safety relay ESR

Application

The electronic safety relay is used for monitoring safety relevant controls. The requirements for the electrical equipping of machines is defined in IEC/EN 60204. The machine operator must assess the risk on his machine to EN 954-1 and install the controls to the necessary safety category 1, 2, 3 or 4.

Surface mounting

The electronic safety relay consists of a mains unit, the electronics and two redundant relays with forced contacts for the switching and indication circuits.



Function

After switch on, in failure free operation the safety relevant circuit is controlled via the electronics and using a relay the switching circuit is switched on.

After switch off and in the case of a failure (earth-fault, short-circuit, wire break) the switching circuit is immediately (stop category 0) or delayed (Stop category 1) switched off and the motor isolated from the mains supply.

In redundant safety circuits a short-circuit is not dangerous, so that only by renewed switch on is the failure recognised and re-switch on is blocked.

Further information sources

Mounting instructions

- Evaluation device for two handed switching ESR4-NZ-21, AWA2131-1743
- Basic device for emergency and safety barrier applications
 - ESR4-NV3-30, ESR4-NV30-30, AWA2131-1838
 - ESR3-NO-31 (230V), AWA2131-1740
 - ESR4-NO-21, ESR4-NM-21, AWA2131-1741
 - ESR4-NO-30, AWA2131-2150
 - ESR4-NT30-30, AWA2131-1884
- Basis device for emergency applications ESR4-NO-31, AWA2131-1742
- Emergency relay ESR4-NE-42, ESR4-VE3-42, AWA2131-1744

Safety manual , TB0-009D

Main catalogue Industrial Switchgear, Section 4 "monitoring relays".

Contactors and Relays

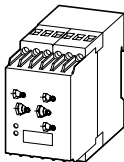
Measurement and monitoring relay EMR4

General

For the various applications measurement and monitoring relays are necessary. With the new EMR4 range Moeller covers a large number of requirements :

- general use, current monitor EMR4-I
- space saving monitoring of the rotary field, phase sequence relay EMR4-F
- protection against destruction or damage of single system parts, phase monitoring relay EMR4-W
- safe recognition of phase failure, phase imbalance monitoring relay EMR4-A
- increased safety by motor current principle , level relay EMR4-N
- increase of the operational safety, insulation monitoring relay EMR4-R

Current monitoring relay EMR4-I



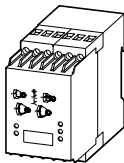
The current monitoring relay EMR4-I is suitable for the monitoring of AC as well as DC current. Pumps and drill machines can be monitored for low load or overload. That is due to the selectable under or over limit.

There are two versions each with three measuring ranges (30/100/1000 mA, 1.5/5/15 A). The multi-voltage coil allows universal use of the relay. The two auxiliary changeover contacts allow for a direct feedback.

Selected bridging of short current peaks

By using the selected time delay of between 0.05 and 30 s short current peaks can be bridged.

Phase monitoring relay EMR4-W



The phase monitoring relay EMR4-W monitors as well as the field rotation also the voltage height. That means protection against destruction or damage of single system parts. Here the minimum low voltage and also the maximum over voltage can be easily set, within a defined range, to the required voltage.

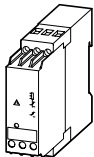
Also a delayed on or a delayed off can be set. In the delayed on position short voltage breaks can be bridged. The delayed off position allows for a failure storage for the set time. The delay time can be set between 0.1 and 10 s.

The relay activates with the correct rotation and voltage. After drop-out the device reactivates when a the voltage exceeds a 5 % hysteresis.

Contactors and Relays

Measurement and monitoring relay EMR4

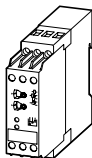
Phase sequence relay EMR4-F500-2



With the only 22.5 mm wide phase sequence relay, portable motors, by which the direction of rotation is important (e. g. pumps, saws, drills), can be monitored for correct rotation. That means space in the switchboard due to the narrow width and protection against damage due to the monitoring of the rotating field.

With correctly rotating field the changeover contact switches the control voltage of the motor switching device. The EMR4-F500-2 covers the total voltage range from 200 to 500 V AC.

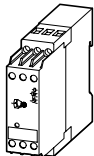
Level monitoring relay EMR4-N



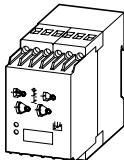
The level monitoring relay EMR4-N is used mostly as dry running protection for pumps or for level regulation of liquids. It operates with sensors that measure conductivity. A sensor is required for the maximum and also a sensor for the minimum level. A third sensor is used for earth potential.

The 22.5 mm wide device EMR4-N100 is suitable for conductive liquids. It can be switched from level regulation to dry running protection. The safety is increased as in both cases the motor current principle is used.

Phase imbalance relay EMR4-A



The 22.5 mm wide phase imbalance relay is the correct protection device against phase failure. The motor is then protected against destruction. That the phase failure is monitored on the basis of phase displacement can be recognised with a higher motor feedback and an overload of the motor can be prevented. The relay is able to protect motors with a rated voltage of $U_n = 380 \text{ V}$, 50 Hz.

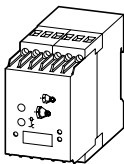


The level monitoring relay EMR4-N500 has an increased sensitivity and is suitable for less conductive liquids. Due to an integrated rise and fall delay of between 0.1 and 10 s moving liquids can also be monitored.

Contactors and Relays

Measurement and monitoring relay EMR4

Insulation monitoring relay EMR4-R



EN 60204 "Safety of machines" provides increased operational safety by the monitoring of the control voltage circuit for earth-fault using an insulation monitor. This is the main application for the EMR4-R. There are similar requirements in medically used areas. An earth-fault is signalled via a changeover contact so that a fault can be cleared without expensive down time.

The device has a selectable fault memory so that the fault must be acknowledged after it's removal. By the use of a Test button the device can be checked for correct operation at any time.

AC or DC control voltage

There is a device for AC and also DC. Therefore the total control voltage range is covered. The DC device has a multi-voltage source. Therefore AC as well as DC is possible.

Further information sources

Mounting instructions

- Phase imbalance monitoring relay EMR4-A400-1 AWA2431-1867
- Insulation monitoring relay EMR4-RAC-1-A AWA2431-1866
- Insulation monitoring relay EMR4-RDC-1-A AWA2431-1865
- Level monitoring relay EMR4-N100-1-B AWA2431-1864
- Phase sequence relay EMR4-F500-2 AWA2431-1863
- Phase monitoring relay EMR4-W... AWA2431-1863
- Current monitoring relay EMR4-I... AWA2431-1862

Main catalogue Industrial Switchgear, Section 4 "monitoring relays".