6.3.3 Testing the Pick-Up and Disengaging Values

For optimal protection many functions in this motor protection relay are interlinked and hence it is not possible to have all protective elements tested independently from each other.
For all functions linked with the START/STOP/RUNNING recognition, a start simulation has to be performed so that the function can be tested under real conditions. Some of the tests could be simplified if special parameters would be set, but in most of the cases this is not wanted.
Hence for testing the short-circuit element I>>RUNNING, for instance, the MRM3-2 has to recognise the simulated running condition firstly. The test source must be able to copy the course of the motor current exactly as it is in reality. The required test short-circuit current can only be injected after the MRM3-2 has recognized the running condition. The test conditions of the other elements, i.e.:

I>
I<
I>> Start
I>> RUNNING

have to be adjusted according to the application of the selected parameters.

6.3.4 Testing the maximum starting time

The timer for maximum starting time starts running if the impressed current exceeds the overload threshold of k*IB> immediately after exceeding the starting threshold and within the start recognition time. There will be trip-ping if the threshold k*IB> is not underscored again after the set time has expired. There are two possibilities of adjustment. If the tripping characteristic for the max. starting time is set to "DEFT" (Definite Time), tripping takes place after the set time has expired. If the parameter is set to "INVS" (Inverse Time Characteristic), the tripping time is dependent on the set rated starting current and a time multiplier. The multiplier is set with the same parameter as in case of the maximum starting time with defined tripping time. The maximum tripping time is limited to 2 x standard time. The minimum tripping time is limited to the shortest possible tripping time of the MRM3-2.

6.3.5 Testing the thermal image

For the thermal image there is no start simulation required. But for true propositions it is important that each start proceeds from distinct start conditions. The thermal behavior of the motor is taken into account in the thermal image. This means that the time for simulated cooling down and for the store to be back to zero after a test can be accordingly. (The store can also be reset manually). As general rule applies that at constant current 99 % of the thermal processes have reached their final value after 5 times the time constant (warming up or cooling down).

6.3.6 Testing the Control Inputs

Prior to the test it should be ensured that the voltage ranges of the inputs (jumper) are correctly adjusted (see chapter 3.1.4).

6.3.7 Testing the CB Failure Protection

For this test the test source must be able to simulate a circuit breaker and switch-off the current after a selectable time when the MRM3-2 was triggered (see chapter 5.4.18). To meet these requirements, the test source must have a respective signal input and a timer for switching-off the current.

6.4 Primary Test

As a rule, tests with currents at the CT primary side (real test) can be performed in the same way as tests with secondary currents. It is recommended to carry out primary tests only as an exception and only if it is absolutely necessary (for very essential protective facilities) because in some cases the costs involved and the strain on the system can be rather high. Many functions of the MRM3-2 can be checked during normal operation of the system due to the efficient fault and measuring value indications. So it is possible, for example, to compare the currents shown on the display with the values shown on the ammeters in the switchboard.

6.5 Maintenance

Normally the relays are checked at regular maintenance intervals at site. From user to user these intervals may vary because among other things they depend on the type of relay, the kind of application, significance of the object to be protected, previous experience of the user etc.
For electro-mechanical or static relays normally an annual check is required. For the MRM3-2 the maintenance intervals can be much longer because:

- the MRM3-2 relays are provided with wide-ranging self-test functions and consequently re lay faults are detected and indicated. It is, of course, imperative that the internal self-supervision relay is connected to a central display board.
- The combined measuring functions of the MRM3-2 make monitoring during operation possible.
- The trip test function (TRIP-Test) allows testing of the output relays.

Therefore a maintenance interval of two years is sufficient. When servicing all relay functions incl. setting values, trip characteristics and tripping times ought to be thoroughly checked.

7. Technical Data

7.1 Measuring input

Rated data:	Rated current I_N	1A or 5A
	Rated frequency f_N	50/60 Hz adjustable
Power consumption in current path:	at I_N = 1 A	0.2 VA
	at I_N = 5 A	0.1 VA
Thermal withstand capability Of the current paths:	Current surge	
	(on half-wave)	250 x I_N
	for 1 s	100 x I_N
	for 10 s	30 x I_N
	continuously	4 x I_N
Fault recorder		
Recorded tracks:	i_{L1}, i_{L2}, i_{L3}, i_E	
Sampling rate:	1.25 ms at 50 Hz	
	1.041 ms at 60 Hz	
Storage capacity:	16 s (at 50 Hz) resp.	
	13.33 s (at 60 Hz)	
Number of events:	1-8	

7.2 Common data

Dropout to pickup ratio:	>97%
Returning time: 40 ms	
Time lag error class index E:	±20 ms
Minimum operating time:	40 ms
Transient overreach at instantaneous operation:	≤5%
Permissible interruption of the supply voltage without affecting the relay function:	50 ms

Influences on the current measurements

Auxiliary voltage:	in the range of $0.8 < U_H / U_{HN} < 1,2$
	No additional influences can be measured
Frequency:	in the range of $0.9 < f / f_N < 1.1$; <0.2%

Measuring errors at higher frequencies: 70Hz – 400Hz < 0.2% / Hz
Influences on delay time: no additional influences can be measured

For further technical data see the general description „MR-Multifunctional Relay“.

7.3 Setting ranges and steps

7.3.1 System parameter

*) One parameter can be marked by several LEDs

Parameter	LED *	Setting range		Range	Step	Tole-rance
Transformer ratio phase current Iprim	L1 L2 L3	SEK 0.002... 50.0 kA	Displayed in x I_N Displayed in kA	0.002-0.200 0.200-0.500 0.500-1.00 1.00-2.00 2.00-5.00 5.00-10.0 10.0-20.0 20.0-50.0	0.001; 0.002; 0.005; 0.01; 0.02; 0.05; 0.1; 0.2	
Transformer ratio earth current $Iprim_E$	E	SEK 0.002... 50.0 kA	Displayed in x I_N Displayed in kA	0.002-0.200 0.200-0.500 0.500-1.00 1.00-2.00 2.00-5.00 5.00-10.0 10.0-20.0 20.0-50.0	0.001; 0.002; 0.005; 0.01; 0.02; 0.05; 0.1; 0.2	
Operating hour meter	h	Y=00...28	years		1 year	
	h	0000... 8759	hours		1 hour	
Motor starts	No	0000... 9999	Number of starts		1	
Rated frequency	-	f=50 f=60	Hz			
LED flashing after activation	-	NOFL FLSH	no yes			
Date and time	🕒	Y=00... 99 M=01...12 D=01... 31* h=00... 23 m=00...59 s=00... 59	Year Month Day (*depends on month) Hour Minute Second		1 year 1 month 1 day 1 hour 1 minute 1 second	
Parameter set changeover switch	P2	SET1 SET2	active parameter set			

7.3.2 Time over current protection

Parameter	LED	Setting range	Notes	Range	Step	Tolerance
Therm. Permissible contin. current k x I_B	I_B	0.20...4.00 EXIT	x I_N Step switched off		0.01; 0.02; 0.05; 0.1 x I_N	±3% of setting value or ±10mA
Overload factor	k	0.80...1.20			0.01	
As warning or tripping step	I_B>+τ_W	warn trip	Step signals warning Step signals tripping			
Excitation delay for I_B>*k	I_B>+t>	0,1...260		0.04-1.00 1.00-2.00 2.00-5.00 5.00-8.00 8.00-10.0 10.0-20.0 20.0-50.0 50.0-100 100-200 200-260	0.02 0.05 0.1 0.2 0.5 1.0 2.0 5.0 10.0 20.0	±3% of setting value or ±25ms
Heating time constant	τ_W	0.5...180	min	0.5-2.0 2.0-5.0 5.0-10 10-20 20-50 50-100 100-180	0.1 0.2 0.5 1.0 2.0 5.0 10.	±3% referring to current measuring value or ±30ms (See EN 60255-3)
Time limit	τ_W Start	t2x t6x EXIT	ab 2 x k*I_B ab 6 x k*I_B no limitation			
Cooling down factor	τ_C	1.00...8.00	x τ_W	1.00-2.00 2.00-5.00 5.00-8.00	0.05 0.1 0.2	±3% referring to measuring value or ±30ms (See EN 60255-3)
Warn step ther. image	ϑ>	20...99 EXIT	Warning at % ϑ> Step switched off	20-99	1	±1% of the setting value
Undercurrent	I<	0.10...1.00 EXIT	Trip delay x I_N Step switched off	0.100-0.200 0.200-0.500 0.500-1.00	0.005 0.01 0.02	±3% of the setting value or ±10mA
	I<+t>	0,1...260 EXIT	Trip delay in s Warning only	0.04-1.00 1.00-2.00 2.00-5.00 5.00-8.00 8.00-10,0 10.0-20,0 20.0-50,0 50.0-100 100-200 200-260	0.02 0.05 0.1 0.2 0.5 1.0 2.0 5.0 10.0 20.0	±3% of the setting value or ±25ms
Over current	I>	0.2...4.0 EXIT	Pick-up value x I_N Step switched off	0.20-0.50 0.50-1.00 1.00-2.00 2.00-4.00	0.01 0.02 0.05 0.1	±3% of the setting value or ±10mA
Characteristics	I>+CHAR	DEFT NINV	definite normal inverse			

Parameter	LED	Setting range	Notes	Range	Step	Tolerance
		VINV EINV RINV LINV	very inverse extremely inverse RI-inverse Long-term inverse			
Time delay	I>+t>	at DEFT: 0.04 ...260	Time delay in s	0.04-1.00 1.00-2.00 2.00-5.00 5.00-8.00 8.00-10.0 10.0-20.0 20.0-50.0 50.0-100 100-200 200-260	0.02 0.05 0.1 0.2 0.5 1.0 2.0 5.0 10.0 20.0	±3% of the setting value or ±25ms
		at _INV: 0.05 - 20 EXIT	Characteristic parameter Warning only	0,05-0,50 0,50-1,00 1,00-2,00 2,00-5,00 5,00-10,0 10,0-20,0	0,01 0,02 0,05 0,1 0,2 0,5	±3% related to the measured current value or ±30ms (See EN 60255-3)
Short-circuit step at start	I>> Start	0.5...40 EXIT	Pick-up value x I_N during Start Step switched off	0.50-1.00 1.00-2.00 2.00-4.00 4.00-10.0 10.0-20.0 20.0-40.0	0.02 0.05 0.1 0.2 0.5 1.0	±3% of the setting value or ±10mA
Time delay	I>> Start+t>	0.04...10 EXIT	Tripping delay in s warning only	0.04-1.00 1.00-2.00 2.00-5.00 5.00-10.0	0.02 0.05 0.1 0.2	±3% of the setting value or ±25ms
Running	I>>	0.5...40 EXIT	Pick-up value x I_N During running Step switched off	0.50-1.00 1.00-2.00 2.00-4.00 4.00-10.0 10.0-20.0 20.0-40.0	0.02 0.05 0.1 0.2 0.5 1.0	±3% of the setting value or ±10mA
Trip delay	I>>+t>	0.04...10 EXIT	Trip delay in s Warning only	0.04-1.00 1.00-2.00 2.00-5.00 5.00-10.0	0.02 0.05 0.1 0.2	±3% of the setting value or ±25ms

7.3.3 Load Unbalance Protection

Parameter	LED	Setting range	Notes	Range	Step	Tolerance
Load unbalance	I2>	0,02...1,00 EXIT	Pick-up value negative phase sequence system - displayed in x I_N - Step switched off	0.020 0.050 0.050 - 0.100 0.100 - 0.200 0.200 - 0.500 0.500 - 1.00	0.001 0.002 0.005 0.01 0.02	±3% of setting value or ±10mA
Characteristics	I2>+CHAR	DEFT INVS	definite DMT inverse IDMT			±3% in relation to the measured current value or ±30ms (see EN 60255-3)
Time delay/ characteristic parameter	I2+t>	At DEFT: 1.00 ...600	Trip delay in s	1.0-5.0 5.0-10.0 10.0-20.0 20.0-50.0 50.0-100 100-200 200-600	0.1 0.2 0.5 1.0 2.0 5.0 10.0	±3% of the setting value or ±25ms
		at INVS: 10.0 - 5000 EXIT	Characteristic parameter Warning only	10.0-20.0 20.0-50.0 50.0-100 100-200 200-500 500-1000 1000-2000 2000-5000	0.5 1.0 2.0 5.0 10 20 50 100	±3% referring to current measuring value or ±30ms (See EN 60255-3)

7.3.4 Earth fault protection

Parameter	LED	Setting range	Notes	Range	Step	Tolerance
Earth fault protection	$I_{E>}$	0,01...2,0 EXIT	pickup value x I_N element blocked	0.010 - 0.050 0.050 - 0.100 0.100 - 0.200 0.200 - 0.500 0.500 - 1.00 1.00 - 2.00	0.001 0.002 0.005 0.01 0.02 0.05	±3% of the setting value or ±0.5% of the rated value
As warning or tripping step	I_B>+τ_W	warn trip	Step signals warning Step signals tripping			
Characteristics	I_E+CHAR	DEFT NINV VINV EINV RINV LINV RXIDG	definite normal inverse very inverse extremely inverse RI-inverse Long-term inverse Special characteristic			
Time delay	$I_{E>}$+t>	at DEFT: 0.04 ...260	Trip delay in s	0.04-1.00 1.00-2.00 2.00-5.00 5.00-8.00 8.00-10.0 10.0-20.0 20.0-50.0 50.0-100 100-200 200-260	0.02 0.05 0.1 0.2 0.5 1.0 2.0 5.0 10.0 20.0	±3% of the setting value or ±25ms
Characteristics parameter		at _INV: 0.05 - 20 EXIT	Characteristic parameter Warning only	0.05-0.50 0.50-1.00 1.00-2.00 2.00-5.00 5.00-10.0 10.0-20.0	0.01 0.02 0.05 0.1 0.2 0.5	±3% referring to current measuring value or ±30ms (See EN 60255-3)

Table 7.1: Setting ranges and steps

7.3.5 Circuit breaker failure protection

Parameter	LED	Setting range	Notes	Range	Step	Tolerance
	CB+t>	0.1...2.00 EXIT	CB time Step switched off	0.10-1.00 1.00-2.00	0.02 0.05	

7.3.6 External trip delay

Parameter	LED	Setting range	Notes	Range	Step	Tolerance
	Trip+t>	0,1...260 EXIT	Switching delay in s No trip	0.04-1.00 1.00-2.00 2.00-5.00 5.00-8.00 8.00-10.0 10.0-20.0 20.0-50.0 50.0-100 100-200 200-260	0.02 0.05 0.1 0.2 0.5 1.0 2.0 5.0 10.0 20.0	±3% of the setting value or ±25ms

7.3.7 Trip blocking beginning with the adjusted rated current

Parameter	LED	Setting range	Notes	Range	Step	Tolerance
	Trip+Block	0.5...40 EXIT	Trip blocking from threshold value (x I_N) Function is switched off	0.50 - 1.00 1.00 - 2.00 2.00 - 4.00 4.00 - 10.0 10.0 - 20.0 20.0 - 40.0	0.02 0.05 0.1 0.2 0.5 1.0	±3% of the setting value or ±10mA

7.3.8 Start parameter

Parameter	LED *	Setting range	Notes	Range	Step	Tolerance
Start blocking	Start+No	AUTO* 1.0... 60.0 EXIT	Supervision by thermal reserve Supervision by interval time: Duration of the start period (min) No supervision	 1 - 60	 1,0	±2s for one start cycle
*faded out in AUTO *faded out in AUTO	No. Start+Block+t>	1...20 VARI 1.0...60	Permitted starts per period Remaining interval time Fixed start blocking time min.	 1 - 60	1 1,0	 ±3% of the setting value or ±25ms
Starting time	Start + CHAR	DEFT INVS	Independent time			±3% in relation to the measured current value or ±30ms (see EN 60255-3)
Rated starting current	I_B> +Start	0.5...40 EXIT	Start current at rated voltage (x I_N) Function switched off	0.50 - 1.00 1.00 - 2.00 2.00 - 4.00 4.00 - 10.0 10.0 - 20.0 20.0 - 40.0	0.02 0.05 0.1 0.2 0.5 1.0	±3% of the setting value or ±10mA
Max./Rated starting time of the engine	Start+t>	0.02...500 EXIT	Tripping delay s Step switched off	0.20 - 1.00 1.00 - 2.00 2.00 - 5.00 5.00 - 10.0 10.0 - 20.0 20.0 - 50.0 50.0 - 100 100 - 200 200 - 500	0.02 0.05 0.1 0.2 0.5 1.0 2.0 5.0 10.0	±3% of the setting value or ±25ms
max starting time (Protective function against prolonged start procedure)	I>+0+t>	0.02...500 EXIT	Trip delay s Step switched off	0.20 - 1.00 1.00 - 2.00 2.00 - 5.00 5.00 - 10.0 10.0 - 20.0 20.0 - 50.0 50.0 - 100 100 - 200 200 - 500	0.02 0.05 0.1 0.2 0.5 1.0 2.0 5.0 10.0	±3% of the setting value or ±25ms
Stopping time STOP recognition	I<+0+t>	0.05...10.0	Time until STOP is recognised s	0.50 - 1.00 1.00 - 2.00 2.00 - 5.00 5.00 - 10.0	0.02 0.05 0.1 0.2	±3% of the setting value or ±25ms

7.3.9 Interface parameter

Parameter	LED *	Setting range	Notes	Step	Tolerance
	RS	1 - 32	Slave-Address		
	RS	 2400 4800 9600	Baud-Rate * * */**		
	RS	 even odd no	Parity even*/** odd* none*		

* selectable when Modbus Protocol is used
** fixed setting for RS485

7.3.10 Fault recorder parameter

Parameter	LED	Setting range	Notes	Range	Step	Tolerance
Number of re-cordings*	FR	 1 3 7 2 4 8	Existing re-cordings to be overwritten* 1 x 8 s (6.66s) 3 x 4 s (3.33s) 7 x 2 s (1.66s) Existing re-cordings not to be overwritten* 2 x 8 s (6.66s) 4 x 4 s (3.33s) 8 x 2 s (1.66s)			
Trigger event	FR	P_UP TRIP A_PI TEST	At actuation At trip After actuation Test recording with button <+> and <->			
Pre-trigger time	FR	0,05...8,00	Duration of the previous event S	0.05-8.00	0.05	

* All given times refer to 50 Hz (60 Hz in brackets)

7.4 Tripping characteristics

7.4.1 Tripping characteristic for max. starting time

The formula for calculating the tripping characteristic is:

Inverse Time Characteristic

$$t_{aus} = \frac{1}{\left(\frac{I}{I\_start}\right)^2} \cdot t_s$$ this applies if I/I_Start > = 0,707

t_{aus} = 2 x ts this applies if I/I_Start< 0,707

With: t_{aus} = tripping time
ts = starting time at rated starting current (rated voltage) or rated starting time
I = effective current
I_start = setting value of rated starting current

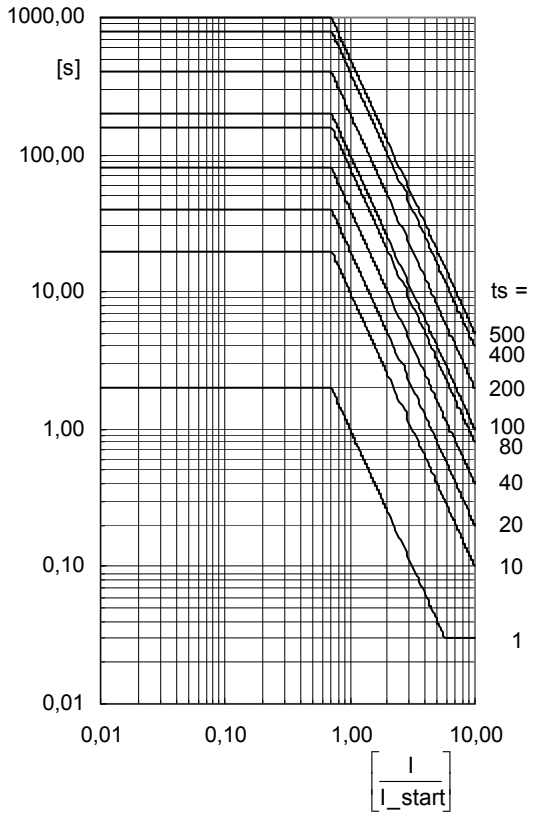

Figure 7.1: Tripping characteristic for max. starting time

7.4.2 Thermal image

The formula for calculating the trip characteristics is as follows:

$$t_{aus} = \tau \cdot \mathrm{In}\left[\frac{\left(\frac{I^2}{(I_B * k)^2} - p^2\right)}{\left(\frac{I^2}{(I_B * k)^2} - 1\right)}\right] \text{ for } p^2 < \frac{I^2}{(I_B \cdot k)^2} \cap p^2 \leq 1$$

with τ = thermal time constant of the object to be protected
I = Relay current (highest measuring value)
IB = Basic current
IP = Initial load current
p = Initial load factor (p = 0 means cold operating component)
k = Constant

7.4.3 Initial load factor

Presentation of the trip with variable initial load factor:

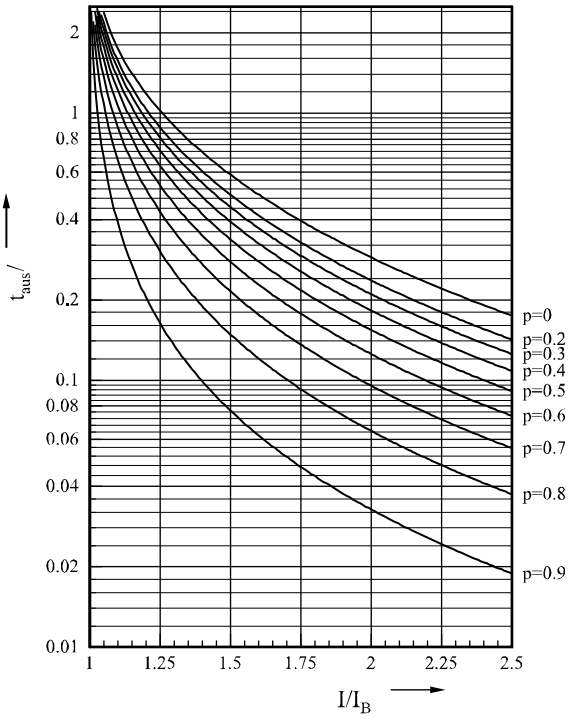

Figure 7.2: Trip Characteristics for Various Initial Load Factors p

7.4.4 Tripping of t2x and t6x - times

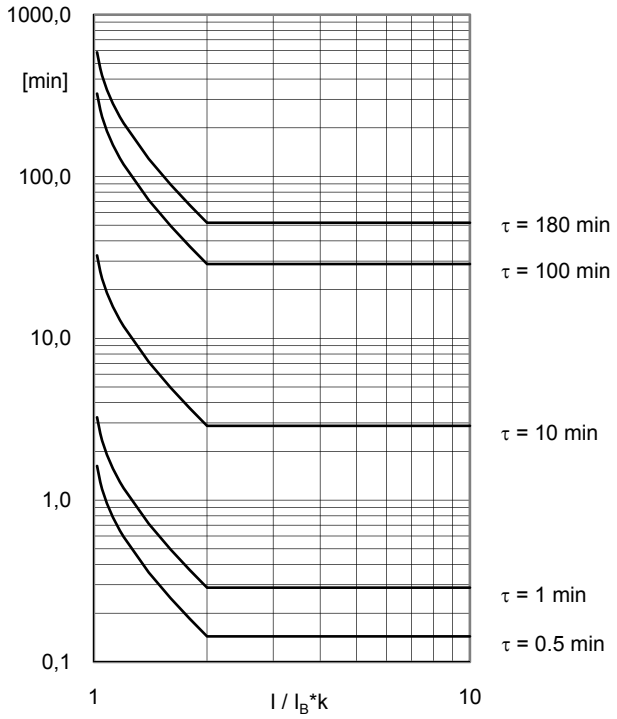

Figure 7.3: Limitation of tripping time 2 x I_N

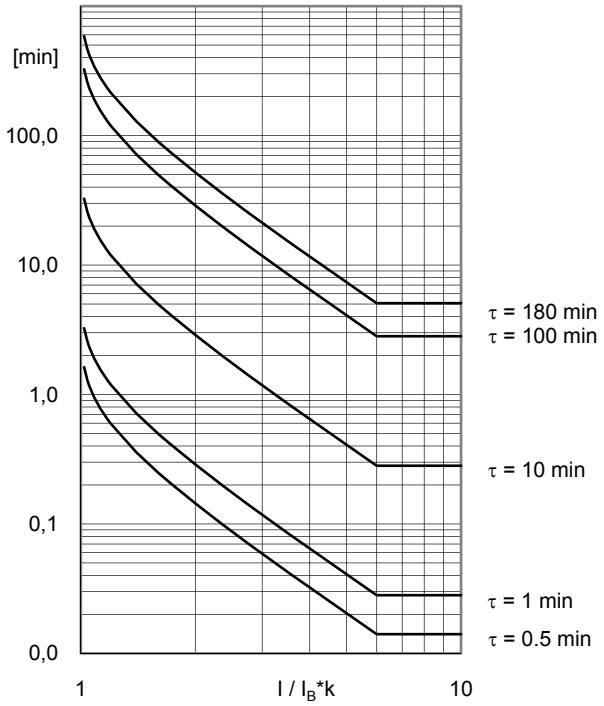

Figure 7.4: Limitation of tripping time 6 x I_N

7.4.5 Inverse time over current protection

Trip characteristics acc. to IEC 255-4 or BS 142

Normal inverse (Type A)

$$t = \frac{0.14}{\left(\frac{I}{I_S}\right)^{0.02} - 1} \cdot t_I > [s]$$

Very inverse (Type B)

$$t = \frac{13.5}{\left(\frac{I}{I_S}\right) - 1} \cdot t_I > [s]$$

Extremely inverse (Type C)

$$t = \frac{80}{\left(\frac{I}{I_S}\right)^{2} - 1} \cdot t_I > [s]$$

Long time inverse

$$t = \frac{120}{\left(\frac{I}{I_S \times I >}\right) - 1} \cdot a[s]$$

RI-inverse

$$t = \frac{1}{0.339 - \frac{0.236}{\left(\frac{I}{I_S}\right)}} \cdot t_I > [s]$$

RXIDG – characteristics

$$t = \left(5.8 - 1.35 \cdot \ell n\left(\frac{I}{Is}\right)\right) \cdot t_{I>}[s]$$

Where:

t	=	Tripping time	
$t_I>$	=	Time multiplier	
I	=	Fault current	
Is	=	Setting value of the current =	natural logarithm

7.4.6 Trip characteristics

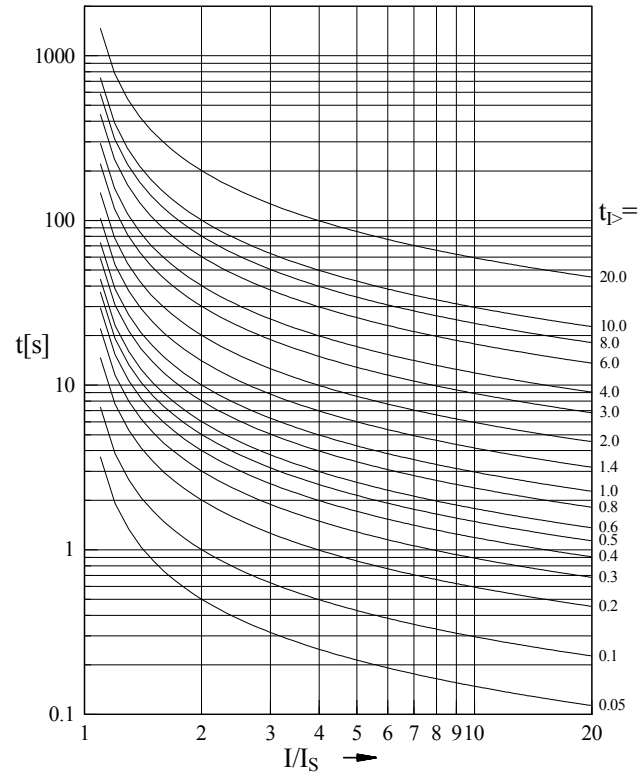

Figure 7.5: Normal Inverse (Type A)

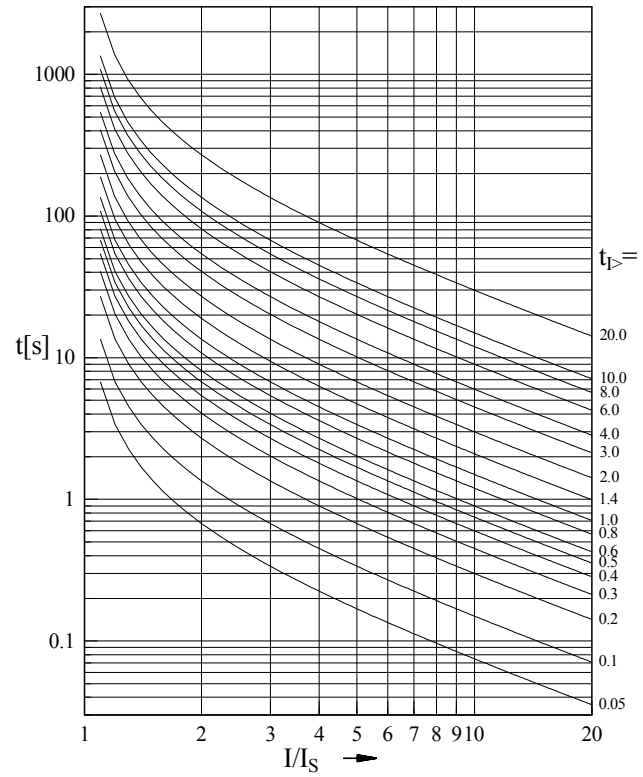

Figure 7.6: Very Inverse (Type B)

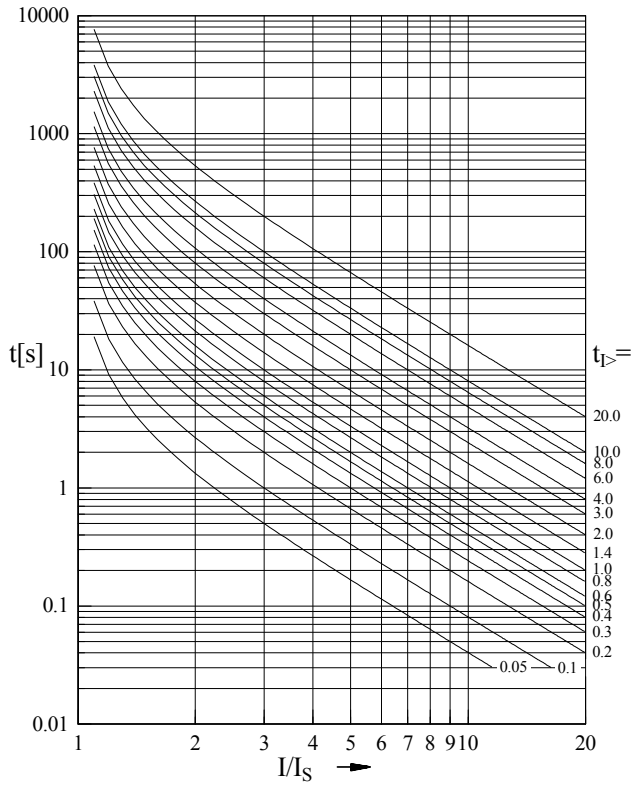

Figure 7.7: Extremely inverse (Type C)

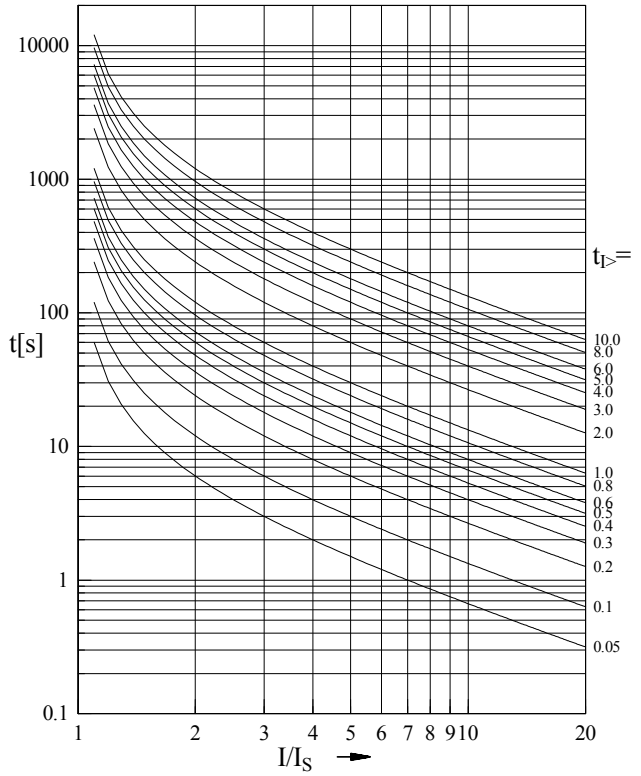

Figure 7.8: Long time inverse

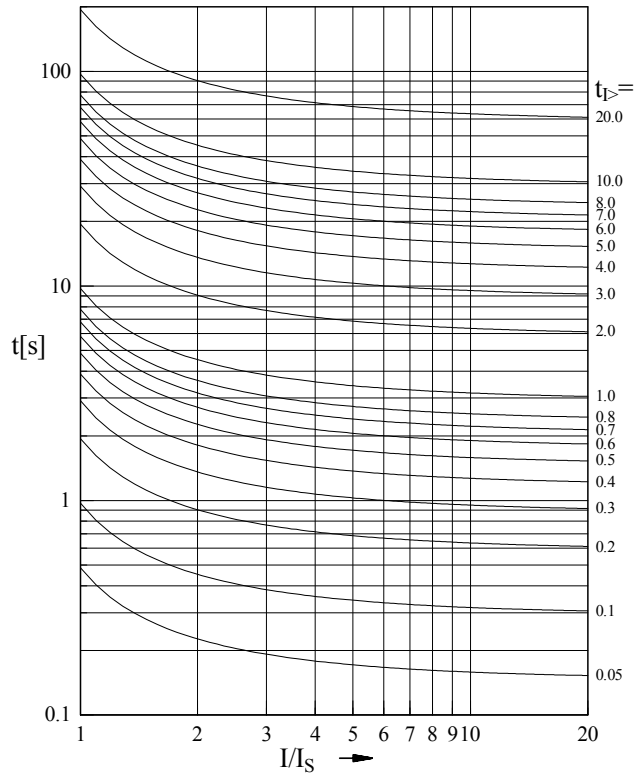

Figure 7.9: RI-inverse

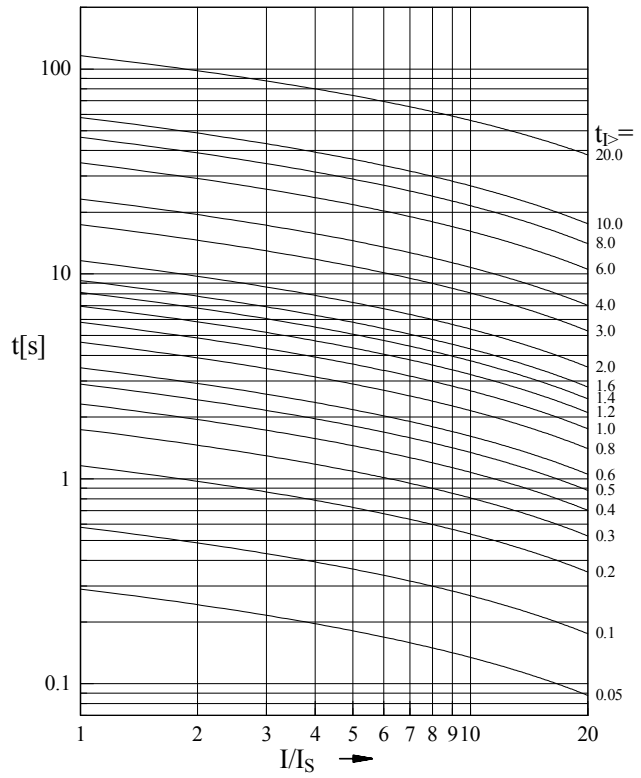

Figure 7.10: RXIDG-characteristic

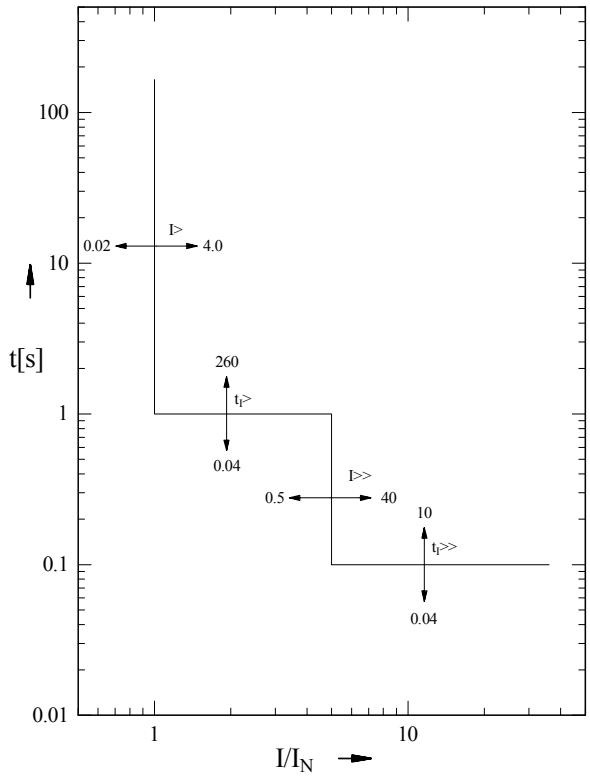

Figure 7.11: Definite trip characteristic

7.4.7 Inverse Time Characteristic for Load Unbalance

Inverse current time protection

$$t = \frac{T}{(I_2/I_{2S})^2 - 1}$$

With: t = tripping time [s]
T = thermal time constant
I_2 = measured load unbalance in relation to IN
I_{2S} = permanently permissible load unbalance in relation to IN

Tripping characteristic

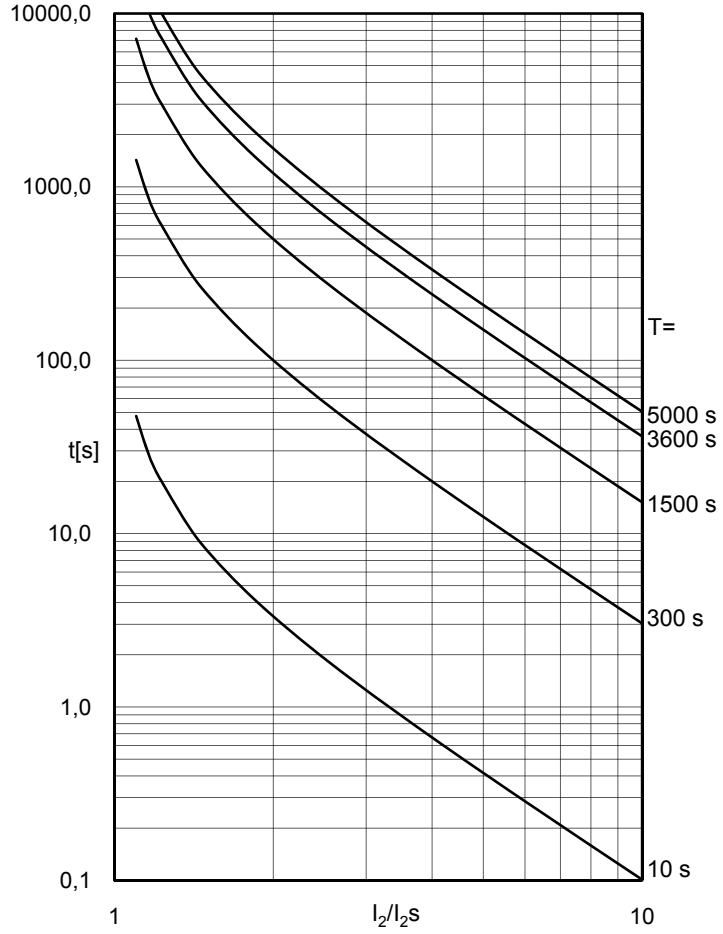

Figure 7.12: Tripping characteristic

7.5 Output relays

Contacts: 2 change-over contacts for relays 1 and 2; 1 change-over contact for relays 3 - 4

This information is subject to technical alterations!!

8. Order form

Motor protection relay with thermal image			***MRM3-***	**2**	**I**		
With additional features such as characteristic for maximum starting time, tripping delay of the thermal overload, tripping/warning for thermal overload							
Phase current	1 A	rated current			**I1**		
	5 A				**I5**		
Earth fault current	Without earth current element					*	
	1 A	rated current				**E1**	
	5 A					**E5**	
Housing (12TE)	19“-rack						**A**
	door installation						**D**
Communication protocol RS485 Pro Open Data; Modbus RTU							**-M**

* Leave box empty, if option is not desired

Setting list for MRM3-2

Project: _____ SEG-Job.-No.: _____

Functional group: = _____ Location: + _____ Relay code: - _____

Relay functions: _____ Password: _____

Date: _____

All settings have to be checked at site and perhaps adjusted to the object to be protected.

Date and time settings

Funktion			I	IE	Default settings
🕒	Year settings	year	X	X	Y = 00
🕒	Month settings	month	X	X	M=01
🕒	Day settings	day	X	X	D=01
🕒	Setting of the hours	hour	X	X	h=00
🕒	Setting of the minutes	minute	X	X	m=00
🕒	Setting of the seconds	second	X	X	s=00

System parameter

Funktion		I	IE	Default settings	Actual settings
L1; L2; L3	$I_{primär}$ (phase)	X	X	SEK	
E	$I_{primär}$ (earth)		X	SEK	
h	Operating hour meter – Years	X	X	Y=00	
h	Operating hour meter – Hours	X	X	0000	
No.	Number of motor starts	X	X	0000	
	50 / 60 Hz	X	X	50Hz	
	Actuation indication	X	X	NO_F	

Protection parameters

		Unit	I	IE	Default setting	Actual setting	
LED	Function				Set1/Set 2	Set1	Set 2
P2	Parameter set change-over switch		X	X	SET1		
I_B>	Basic current of the thermal overload protection	x I_N	X	X	0.20		
k	Constant		X	X	1.00		
I_B> + t>	Excitation delay of the I_B>*k - steps	s	X	X	0.04		
I_B> + τ_W	Warning/tripping of the thermal overloadstep		X	X	trip		
τ_W + Start	t2x and t6x min. tripping time at a start		X	X	EXIT		
τ_W	Time constant (warming)	min	X	X	0.5m		
τ_C	Time constant (cooling down)		X	X	1.0		
ϑ>	Warning element for thermal overload	%	X	X	20		
I<	Pick-up value for phase undercurrent element	x I_N	X	X	EXIT		
I< + t>	Tripping time of the undercurrent element	s	X	X	0.10		
I>	Pick-up value of the phase over current element	x I_N	X	X	0.20		
I> + CHAR	Trip characteristics for the phase over current element		X	X	DEFT		
I> + t>	Tripping time (factor) for the phase over current element	(s)	X	X	0.04		
I>+CHAR + t>	Reset mode for the tripping characteristics		X	X	0s		

Protection Parameters (Contin.)

		Unit	I	IE	Default setting	Actual setting	
LED	Function				Set1/Set2	Set1	Set2
I>> + Start	Pick-up value for the phase short-circuit element at start	x I_N	X	X	0.50		
I>> + Start + t>	Tripping time of the phase short-circuit tripping at start-up	s	X	X	0.04		
I>>	Pick-up value for the phase short-circuit element in operation	x I_N	X	X	0.50		
I>> + t>	Tripping time of the phase short-circuit element	s	X	X	0.04		
I2>	Pick-up value of the load unbalance element	x I_N	X	X	0.020		
I2> + CHAR	Trip characteristic of the load unbalance element		X	X	DEFT		
I2> + t>	Tripping time of the unbalanced load element	s	X	X	1.0		
I2>+CHAR + t>	Reset mode for the load unbalance element		X	X	0s		
I_E>	Pick-up value of the earth fault element	(s)		X	0.010		
I_B>	Warning/tripping of the earth over current steps		X	X	trip		
I_E> + CHAR	Trip characteristic earth fault element			X	DEFT		
I_E>+ t>	Tripping time (factor) earth fault element	(s)		X	0.04		
I_E>+ CHAR + t>	Reset mode earth fault element			X	0s		
CB + t>	Tripping time CB failure protection	s	X	X	EXIT		
Trip + t>	Tripping time external trip	s	X	X	0.10		
Block + Trip	Trip blocking at excessive phase current	x I_N	X	X	EXIT		

Start parameters

Function		Unit	I	IE	Default setting	Actual setting	
LED	Function				Set1/Set2	Set1	Set2
No.+Start	Duration of a start cycle	min.	X	X	30		
No.	Number of starts per cycle		X	X	10		
Start+Block+t>	Start blocking time	min	X	X	30		
Start + CHAR	Characteristic for the starting time		X	X	DEFT		
I_B> + Start	Rated starting current	x I_N			EXIT		
Start + t>	Starting time of engine 8rated starting time with rated voltage)	(s)	X	X	EXIT		
0 + I> + t>	Time of START recognition or MOTOR RUNNING	s	X	X	0.20		
0 + I< + t>	Stopping time	s	X	X	0.50		

Parameters for the fault recorder

LED	Function	Unit	I	IE	Default setting	Actual setting
FR	Number of recordings				4	
FR	Storage of the recording at the event				TRIP	
FR	Time period prior to the trigger impulse	s			0.05	

Interface parameters

LED	Function	I	IE	Default setting	Actual setting
RS	Slave Address of the serial interface		X	1	
RS*	Baud rate of the serial interface		X	9600	
RS*	Parity check of the serial interface		X	even	

*only with Modbus Protocol

Assignment of the blocking functions

LED	Function	Default setting*		Actual setting	
		Set 1	Set 2	Set 1	Set 2
ϑ>	Overload warning	NO_B	NO_B		
I_B> + τ_W	Overload element	NO_B	NO_B		
I<	Undercurrent element	NO_B	NO_B		
I>	Over current element	NO_B	NO_B		
I>> + Start	Short-circuit element at start	PR_B	PR_B		
I>>	Short-circuit element, in operation	PR_B	PR_B		
I2>	Load unbalance element	NO_B	NO_B		
IE>	Earth current element	NO_B	NO_B		
CB	CB failure protection	NO_B	NO_B		
Trip	External trip	NO_B	NO_B		

*NO_B = not blocked; BLOC = blocked; PR_B = blocking actuation; TR_B = blocking trip

Assignment of the reset functions

LED	Function	Default setting		Actual setting	
		Set 1	Set 2	Set 1	Set 2
ϑ>	Overload warning	AUTO	AUTO		
I_B>	Overload alarm	AUTO	AUTO		
I_B> + τ_W	Overload trip	AUTO	AUTO		
I<	Undercurrent alarm	AUTO	AUTO		
I< + t>	Undercurrent trip	AUTO	AUTO		
I>	Over current alarm	AUTO	AUTO		
I> + t>	Over current trip	AUTO	AUTO		
I>> + Start +t>	Short-circuit tripping during start-up	AUTO	AUTO		
I>>	Short-circuit alarm in operation	AUTO	AUTO		
I>> + t>	Short-circuit trip	AUTO	AUTO		
I2>	Load unbalance actuation	AUTO	AUTO		
I2> + t>	Load unbalance trip	AUTO	AUTO		
IE>	Earth current alarm	AUTO	AUTO		
IE> + t>	Earth current trip	AUTO	AUTO		
CB	CB failure protection	AUTO	AUTO		
Trip	External trip	AUTO	AUTO		

* AUTO = Automatic Reset; HAND = Manual Reset

** I>>+Start Short-circuit excitation during start-up is always auto-reset

Assignment of the Output Relays

LED	Function	Relay 1		Relay 2		Relay 3		Relay 4	
		Default setting	Actual setting	Default setting	Actual setting	Default setting	Actual setting	Default setting	Actual setting
ϑ>	ϑ> Actuation			X					
I_B>	I_B> Alarm			X					
I_B>+τ_W	I_B> Trip	X							
I<	I< Alarm			X					
I<+t>	I< Trip	X							
I>	I> Alarm			X					
I>+t>	I> Trip	X							
I>>+Start	I>> Alarm at Start			X					
I>>+Start+t>	I>> Tripping at Start	X							
I>>	I>> Alarm			X					
I>>+t>	I>> Trip	X							
I2>	I2> Alarm			X					
I2>+t>	I2> Trip	X							
IE>	IE> Alarm			X					
IE>+t>	IE> Trip	X							
CB	CB failure protection								
Trip	Ext. trip, undelayed	X							
Trip + t>	Ext. trip, delayed	X							
Start + Block+t>	Start blocking					X			
Start	Motor is starting								
S/R	Motor is running							X	
Start+t>	Excessive start-up time	X							
P2	Parameter Set 2 is active								

Setting of the Coding Plugs

Coding plug	J1		J2		J3	
	Default setting	Actual setting	Default setting	Actual setting	Default setting	Actual setting
Plugged-in						
Unplugged	X		No function		No function	

Digital inputs

Coding plug	Function	Low/High range for blocking input	
Terminal	Low=plugged-in/High=unplugged	Default setting	Actual setting
D8 / A2	Parameter set change-over switch	Plugged-in	
D8 / A5	Ext. Trigger for the fault recorder	Plugged-in	
D8 / A6	Recognition „Motor Running“	Plugged-in	
D8 / A7	Ext. trip, undelayed	Plugged-in	
D8 / A8	Ext. trip, delayed	Plugged-in	
D8 / C8	Reset function	Plugged-in	
D8 / E8	Blocking function	Plugged-in	

This technical description applies as from the use of

Software Version	D01-2.01	MRM3-2-IE MRM3-2-I
Modbus Protocol Software Version	D51-2.01	MRM3-2-IE-M MRM3-2-I-M

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