

# Frost protection for gutters and downpipes

**Melting and refreezing of ice can damage roofs and gutters. Heavy icicles may fall and cause injury. Standing water can leak through interior walls and furnishings. The Raychem self-regulating snow melting system maintains water flow in gutters and drain pipes and provides a path whereby melting ice and snow can drain safely off the roof, along the gutter and down the drain pipe.**

## Practical to install

The self-regulating cable can be closely spaced in gutters without the risk for overheating or burn-outs. There is a cable for each type of roof material.

## Economical to operate

The self-regulating effect saves energy by automatically increasing its heat output in icy water and decreasing its output in dry air. The smart EMDR-10 control unit only switches the heating cable on when necessary: after the detection of both low temperature and moisture.

Connection \* (RayClic-CE-02)

Temperature sensor EMDR-10 (Incl.)

Moisture sensor EMDR-10 (Incl.)

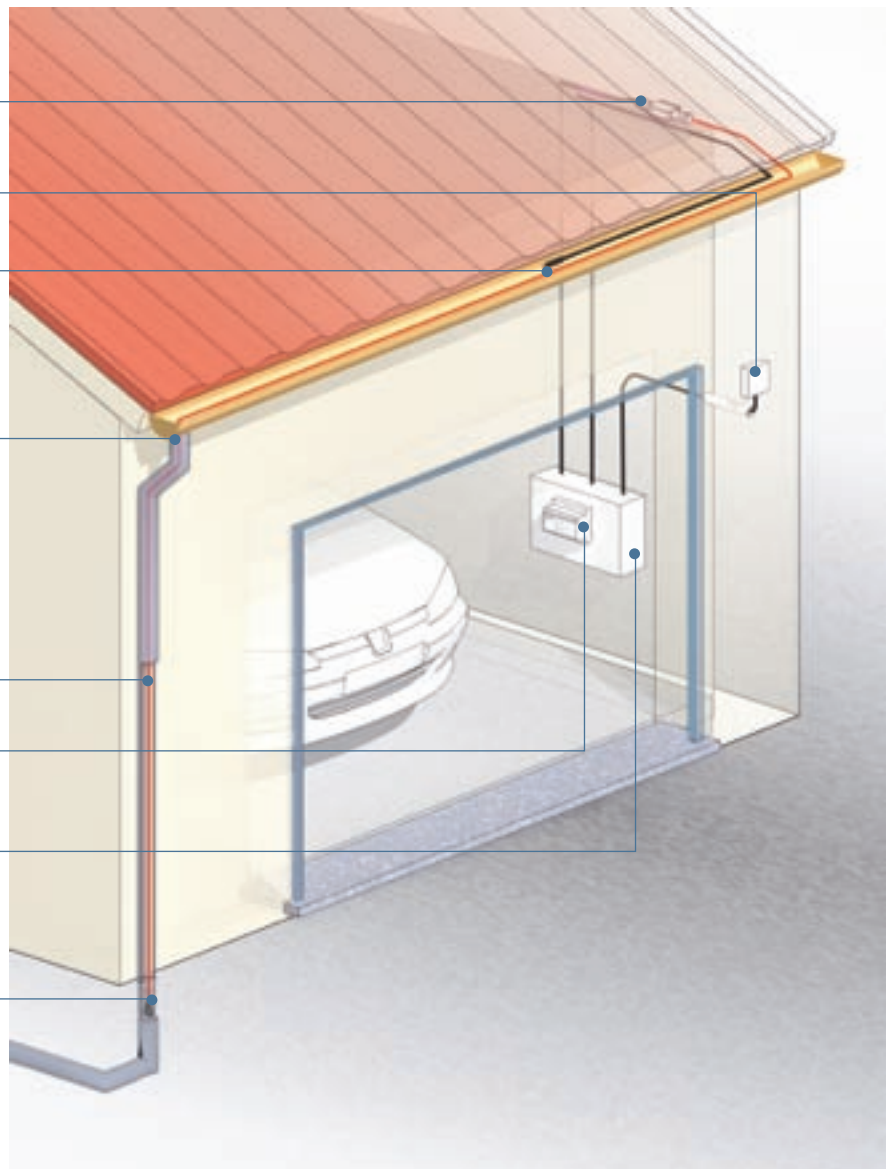
Fixing bracket (GM-RAKE)

Heating cable (GM-2X)

Control unit (EMDR-10)

Residual current device (rcd 30 mA)  
Circuit-breaker (C type)

End seal (RayClic-E-02)



**Do not install RayClic immersed in water.  
Do not bury RayClic in the ground neither in the gutter.**

## Design guide, control units and accessories

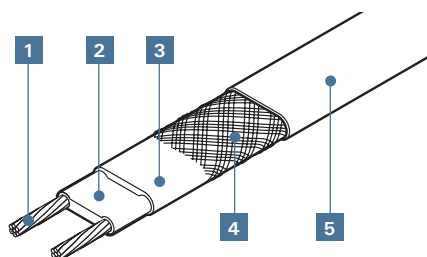
### 1. Heating cable selection

#### GM-2X

Self-regulating heating cable for gutters, drain pipes and roof surfaces:

- 36 W/m in iced water and 18 W/m in air at 0°C

### 2. Composition of the GM-2X heating cable



- 1 Copper conductor (1.2 mm<sup>2</sup>)
- 2 Self-regulating heating element
- 3 Insulation made of modified polyolefin
- 4 Tinned copper braid
- 5 Protective jacket made of modified polyolefin (UV-resistant)

Technical data: see page 53

**Important note:** When laying cables on asphalt, bitumen, roofing felt, etc., a cable with a special fluoropolymer jacket (8BTV-2-CT) must be used.

### 3. Cable length

- The heating cable should be installed in a straight line in the gutter
- The cable lengths should be adjusted according to the geographical situation and the gutters
- More than one cable should be laid in wide valley, parapet or box gutters

Gutter length  
 + drainpipe length  
 + 1 m per connection  
 + 1 m in the soil (frost line)  
 = required heating cable length

### 4. Electrical protection

- The length of heating cable determines the number and size of the circuit breakers
- Residual current device (rcd): 30 mA required, max. 500 m heating cable per rcd
- Installation according to local regulations
- The power connections must be carried out by an approved electrical installer
- Use C type circuit-breakers

**Max. length of the heating circuit is based on a minimum switch-on temperature of -10°C, 230 VAC.**

	GM-2X	8BTV-2-CT
6A	25 m	25 m
10 A	40 m	40 m
13 A	50 m	50 m
16 A	60 m	60 m
20 A	80 m	80 m

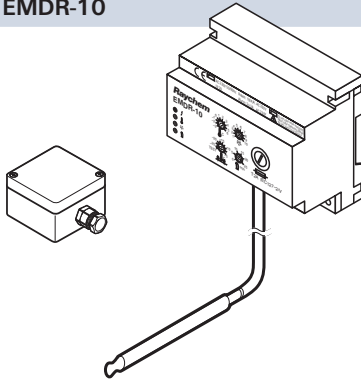
### 5. Testing of the installation

See page 50

# Frost protection for gutters and downpipes

## 6. Control units

### EMDR-10

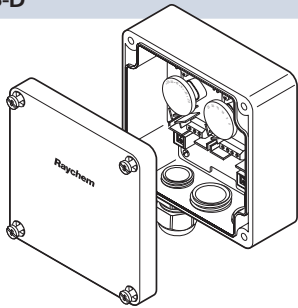


#### Smart control unit

- With temperature and moisture sensor
- User-friendly control
- Saves up to 80% energy
- Max. switching capacity 10 A (otherwise switching by contactor)
- Potential free alarm for sensor break age, sensor short and power loss

Technical data: see page 40

### HTS-D



#### Standard thermostat

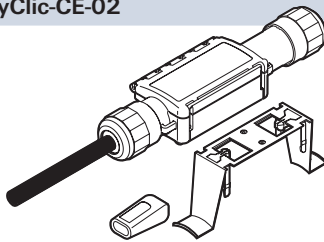
- 2 independent switching points
- Max. switching current: 16 A - 250 VAC
- Temperature adjustment range:  $-20^{\circ}\text{C}$  to  $+25^{\circ}\text{C}$
- Outdoor installation
- Economical for circuit lengths up to 30 m

Technical data: see page 42

## 7. Accessories for GM-2X

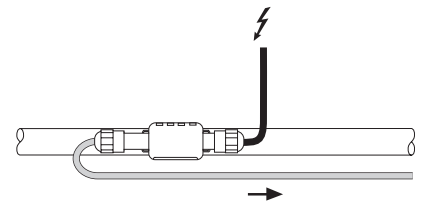
*Avoid installing RayClic in gutters or in places where it may be immersed in water.*

### RayClic-CE-02

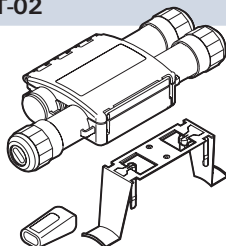


#### Power connection

- With 1.5 m power cable
- End seal and support bracket
- IP 68 weather protection
- External dimension: L = 240 mm  
W = 64 mm  
H = 47 mm

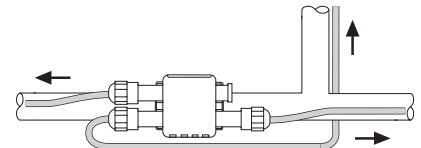


### RayClic-T-02

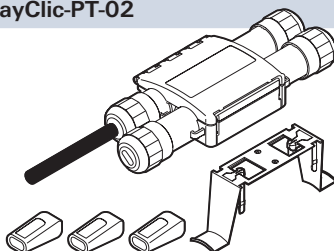


#### T-connection

- Connection for 3 cables
- 1 end seal and 1 support bracket
- IP 68 weather protection
- External dimension: L = 270 mm  
W = 105 mm  
H = 42 mm

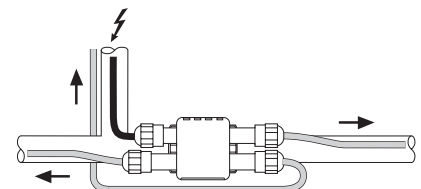


### RayClic-PT-02

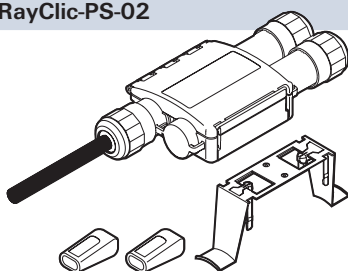


#### Power T-connection

- Connection for 3 cables with integral 1.5 m power cable
- 3 end seals and 1 support bracket
- IP 68 weather protection
- External dimension: L = 270 mm  
W = 105 mm  
H = 42 mm

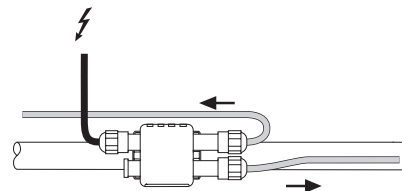


**RayClic-PS-02**

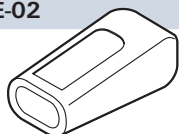


**Powered splice**

- Connection for 2 cables with integral 1.5 m power cable
- 2 end seals and 1 support bracket
- IP 68 weather protection
- External dimension: L = 270 mm  
W = 105 mm  
H = 42 mm



**RayClic-E-02**

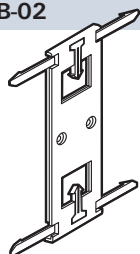


**Gel-filled end seal**

- For system extensions (to be ordered separately)
- IP 68 weather protection

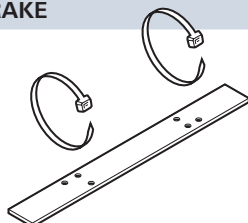


**RayClic-SB-02**



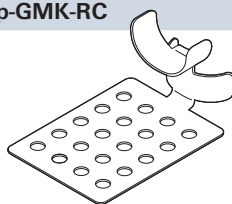
**Wall-mounted support bracket**

**GM-RAKE**



- Fixing bracket/edge protection for drainpipes
- Spacer for use in wide channels or gutters where more than one run of cable is required (a spacer is placed every 100 cm)
- VA steel with UV-resistant cable ties

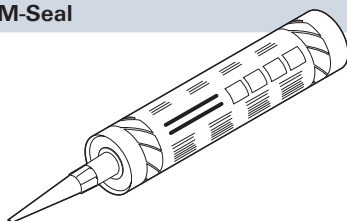
**IceStop-GMK-RC**



**Roof clip to secure heating cables to roofs and gutters.**

Adhesive can be applied on the underside of the roof clip. After curing of the adhesive the heating cable can be clipped between the clamps.

**GM-Seal**

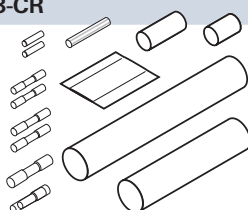


Adhesive for sticking and sealing common construction materials with a base of polyurethane

- 300 ml pack

**Do not use GM-seal for adhesion on asphalt, bitumen, roofing or similar undergrounds**  
Contact your Tyco Thermal Controls representative for more information

**CCE-03-CR**



**Cold lead connection and end seal kit**

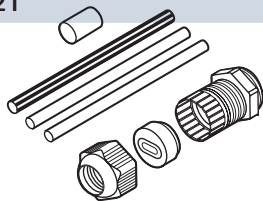
- Connection of 3 x 1.5 mm<sup>2</sup> or 3 x 2.5 mm<sup>2</sup> cold lead cable to self-regulating heating cable GM-2X

# Frost protection for gutters and downpipes

Frost protection for gutters and downpipes

## 8. Accessories for 8BTV-2-CT heating cable

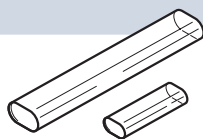
C25-21



### Connection kit

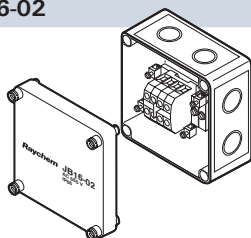
- Heat-schrink technique
- M25 gland

E-06



### End Seal kit

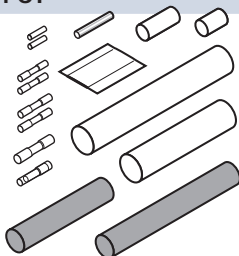
JB-16-02



### Junction box

- IP 66
- 6 x 4 mm<sup>2</sup> terminals
- 4 pg 11/16 and 4 M20/25 knock-out entries

CCE-04-CT



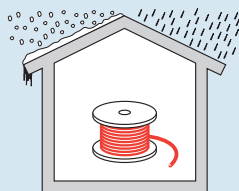
### Cold lead connection and end seal kit

- Connection of 3 x 1.5 mm<sup>2</sup> or 3 x 2.5 mm<sup>2</sup> cold lead cable to self-regulating heating cables BTV-2-CT

## 9. General installation instructions

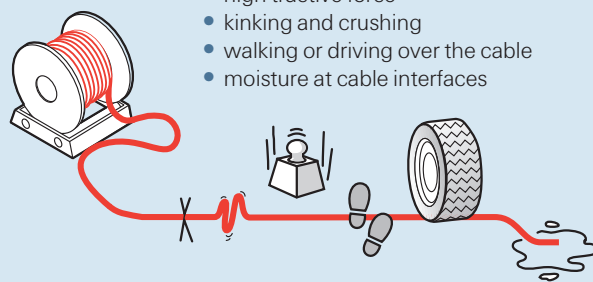
### Installation of self-regulating heating cables

- Store in a dry and clean place.
- Temperature range: -40°C to +60°C.
- Protect any cable ends with an end seal.

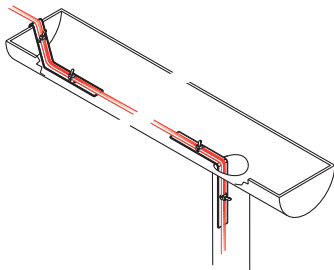


### Avoid:

- sharp edges
- high tractive force
- kinking and crushing
- walking or driving over the cable
- moisture at cable interfaces

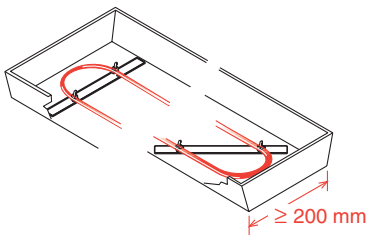


## 10. Special installation instructions



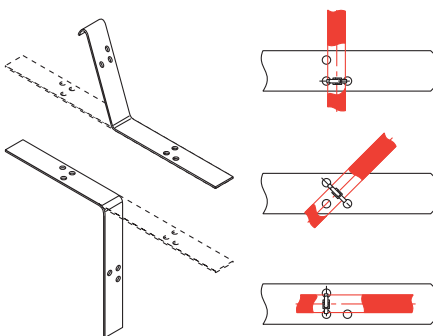
### Box gutter < 200 mm

- One heating cable of GM-2X only



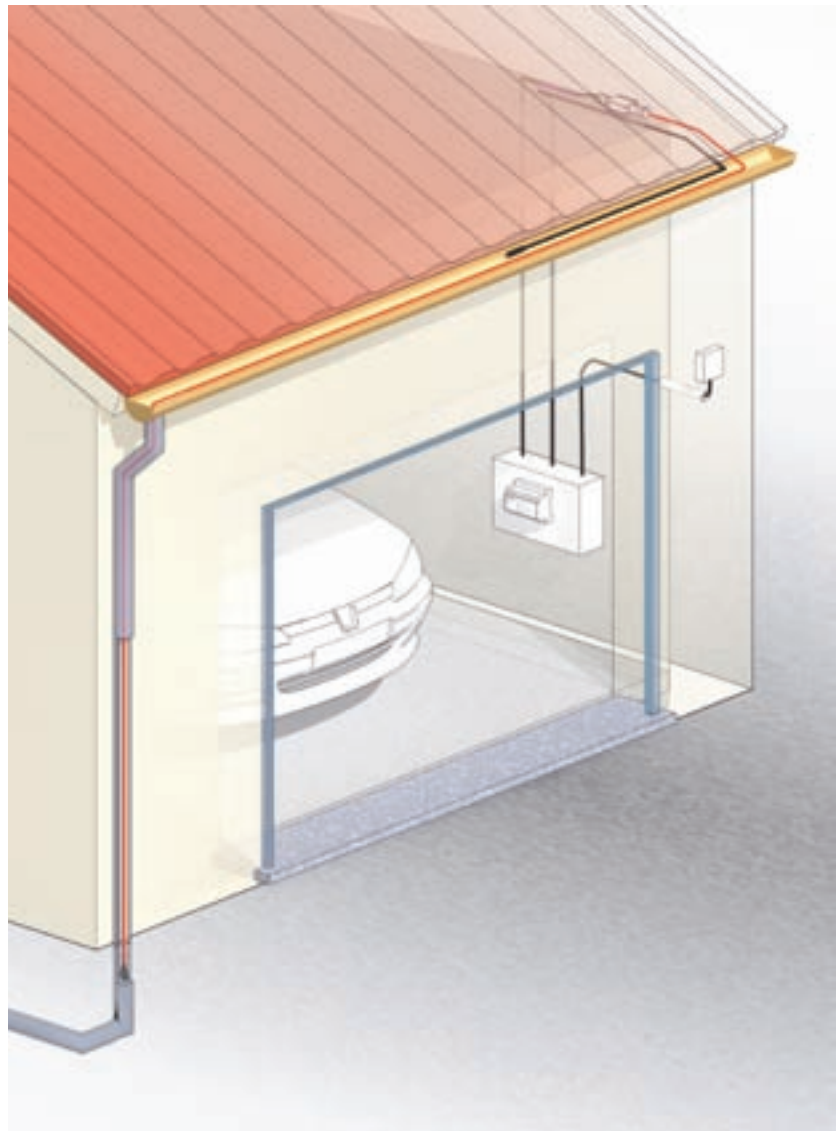
### Box gutter > 200 mm

- Multiple heating cables of GM-2X
- 2 pc spacer GM-RAKE per meter of gutter edges: GM-RAKE provides mechanical protection against damages



### Fastening of the gutter cables

On the roof, eaves bricks, gutter and drainpipe with GM-RAKE edge protection brackets (incl. cable ties).



*In the drainpipe: always put the cable as far as the frost-free area (approx. 1m deep)*

Frost protection for gutters and downpipes

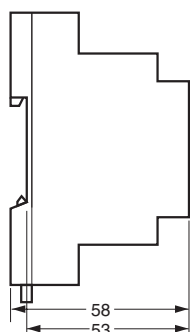
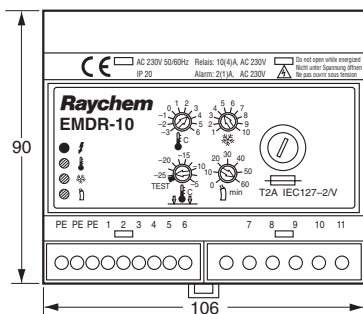
**Do not install RayClic immersed in water. Do not bury RayClic in the ground neither in the gutter.**

# Frost protection for gutters and downpipes

Frost protection for gutters and downpipes

## Temperature and moisture control unit EMDR-10

### Technical data



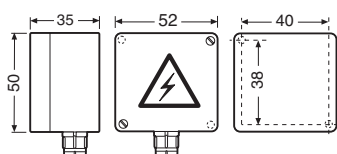
(Dimensions in mm)

Supply voltage	230 VAC, ±10%, 50Hz
Power consumption	max. 4 VA
Max. switching capacity	$I_{max}$ 10(4)A / 230 VAC, SPST, potential 230 VAC
Temperature adjustment range	-3°C to +6°C (factory setting +2°C)
Lower limit temperature adjustment range	test, -25°C to -5°C (factory setting -15°C)
Operating differential	±0.5 K
Measuring accuracy	±1.5 K
Moisture adjustment range	1 (max. sensibility) to 10 (min. sensibility) (factory setting 5)
Post heating time adjustment range	0 to 60 minutes (factory setting 60 minutes)
Alarm relay	$I_{max}$ 2(1)A / 230 VAC, SPDT, potential-free
Moisture sensor (output)	$I_{max}$ 315mA / 230 VAC, with fuse 5 x 20mm T 315mA according to IEC 127-2/V
Mounting	DIN rail according to DIN EN 50022-35
Low voltage directive	EN 60730
EMC	EN 50081-1 (emission) and EN 50082-1 (immunity)
Terminals	2.5 mm <sup>2</sup> (stranded conductors), 4 mm <sup>2</sup> (solid conductors)
Protection class	II (panel mounted)

### Housing

Ambient temperature range	0°C to +50°C
Ingress protection	IP20
Housing material	Noryl (self-extinguishing according to UL 94 V-0)
Weight	approx. 350 g

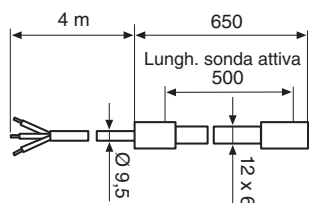
### Ambient temperature sensor (VIA-DU-A10)



PG9 (Dimensions in mm)

Sensor type	PTC (FL 103)
Ingress protection	IP54
Terminals	2.5 mm <sup>2</sup>
Sensor cable	2 x 1.5 mm <sup>2</sup> , max. 100 m (not included)
Exposure temperature	-30°C to +80°C
Mounting	Wall mounting

### Moisture sensor (HARD-45)



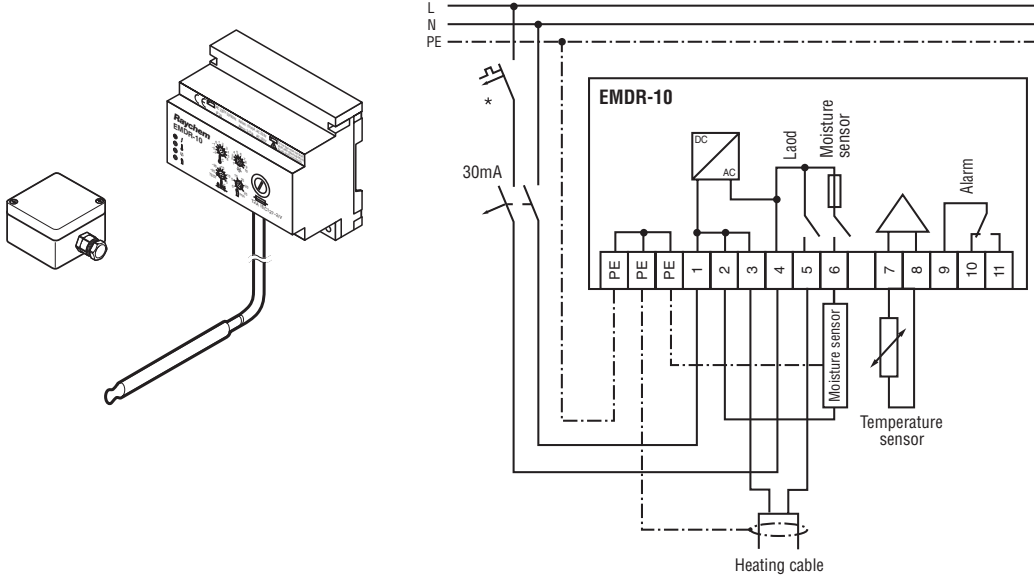
(Dimensions in mm)

Sensor type	PTC
Power consumption	9 W to 18 W
Ambient temperature range	-30°C to +65°C continuous
Supply voltage	230 VAC, ±10%, 50Hz
Connection cable	3 x 1.5 mm <sup>2</sup> , 4 m, the connection cable can be extended to max. 100 m at 3 x 1.5 mmU 45 Unipers

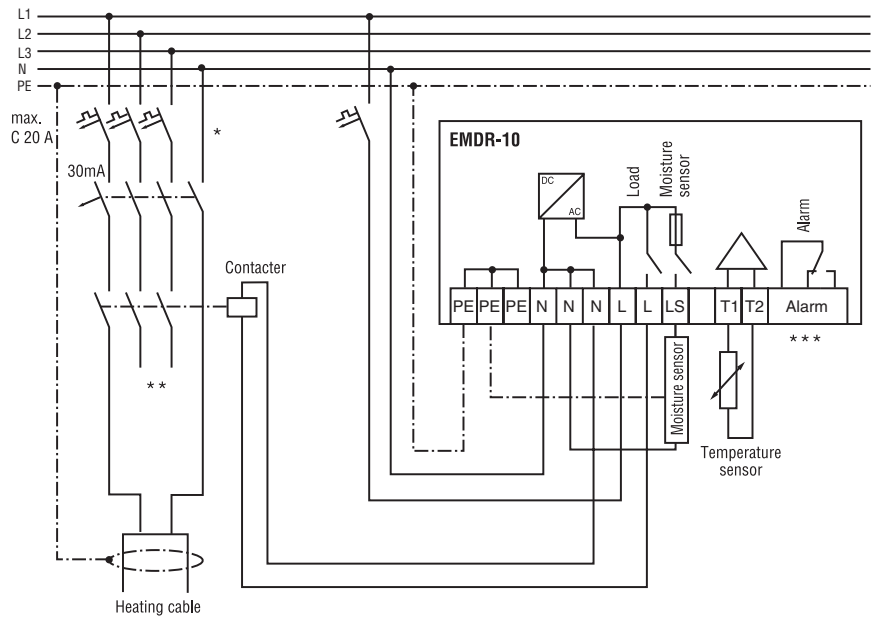


# Wiring diagram for EMDR-10

## EMDR-10 without contactor



## EMDR-10 with contactor



- \* Two- or four-pole electrical protection by circuit breaker may be needed for local circumstances, standards and regulations
- \*\* Depending on the application, one or three-pole circuit breakers or contactors may be used
- \*\*\* Potential-free alarm contacts for connection to the BMS

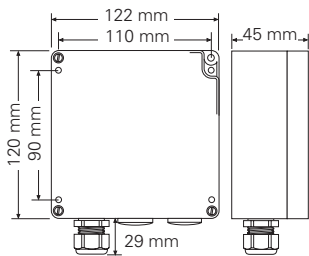
Frost protection for gutters and downpipes



# Frost protection for gutters and downpipes

## Thermostat HTS-D

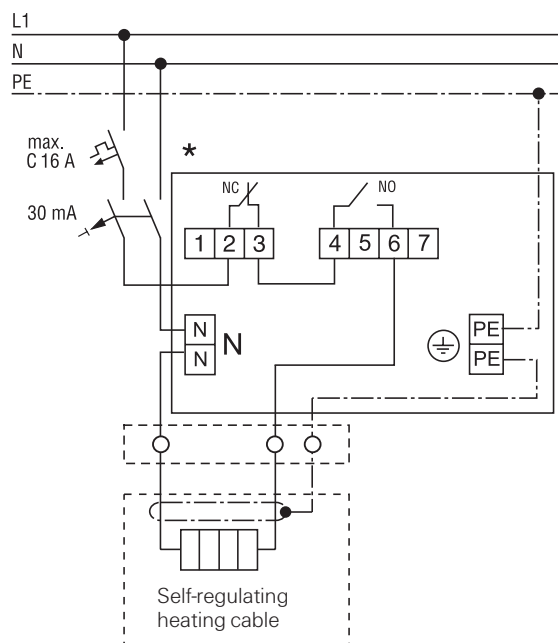
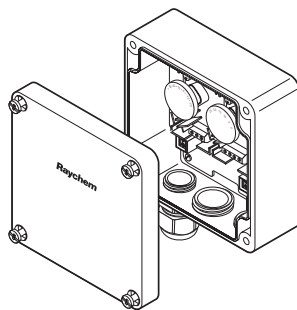
### Technical data



Temperature range	-20°C to +25°C
Operating voltage	AC 230 V, 50 Hz
Max. switch current	16 A / AC 250 V
Max. exposure temperature	50°C
Switch temperature difference	1 K - 3 K
Temperature setting	under the housing cover
Protective system	IP 65

## Wiring diagram for HTS-D

### HTS-D direct



\* Two- or four-pole electrical protection by circuit-breaker may be needed for local circumstances, standards and regulations

# General installation instructions

## Checklist for problem-free installation and safe operation

### Typical installation schedule for hot water temperature maintenance

#### General order of events

- The system is designed and the installation planned
- The pipework is pressure tested or otherwise checked for leaks
- The HWAT-L/M/R cable is tested and then installed on the designated pipes
- The components are installed and each circuit is tested
- The correct thermal insulation is applied, without delay, labelled and the system test repeated
- The supply voltage cables and circuit breakers are installed to each circuit
- The system is commissioned (see "System start-up" below)

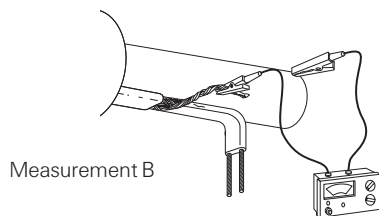
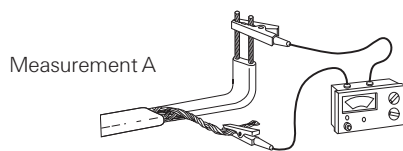
### Circuit protection, testing and operation for all systems

#### Circuit protection

- Supply voltage 230 VAC, 50 Hz
- The required protective measures of the relevant regulations must be complied with.
- C type circuit breaker (anti-surge fuse)
- Residual current device (rcd 30 mA) required. Maximum approx. 500 m of self-regulating heating cable can be monitored per rcd

#### Testing

- Visual inspection for damage and fault-free installation of the accessories
- Proper installation of the system
- Heating cable affixed to all necessary pipes
- No mechanical damage to heating cable (e.g. cuts, cracks, etc.)
- No thermal damage
- Proper connection of all components including power supplies
- Insulation resistance measurement when heating cable is received and before and after installation of the thermal insulation. The test voltage should be 2500 VAC, but it must not be lower than 500 VAC. The insulation resistance, irrespective of the cable length, must not be less than 100 Mohms.  
If the resistance falls below this value, the source of the fault must be investigated, eliminated, and re-tested.
  - Measurement A: Phase and neutral to the braid
  - Measurement B: Braid to the pipework
- After switching on, the cable ends must be warm after 5 to 10 minutes



#### Instructions for the placing of the heat insulation

- For problem-free operation of the self-regulating heating cables, the material quality and thickness of the thermal insulation should be in accordance with the design parameters, and this insulation must be installed correctly
- All parts of the pipework, including valves, wall transit points, etc. must be fully insulated

#### Operation / System start-up

- 1) For small installations, turn on the circuit breakers and preferably leave the system overnight for the water to warm up and stabilise
- 2) For bigger installations or for a faster start-up, first turn on the main water heater and open the outlet/tap at the end of the pipework run until the water feels warm and then turn on the circuit breakers  
If the piping system is closed, such as by pressure-reducing valves or isolation valves, you must provide some method of pressure relief to allow for thermal expansion of the water during heat-up
- Under normal operating conditions, the heating cables are maintenance-free. Tyco Thermal Controls recommend that the insulation resistance should be checked periodically and compared with the original values. If the reading falls below the minimum value (100 Mohms) determine the cause and rectify before re-use
- The specified maximum ambient and operating temperatures should not be exceeded
- In the event of repair to the pipework, the heating cable must be protected against damage. Correct function of the electrical protection system should be maintained. To prevent shock or personal injury, turn off the power at the circuit breaker before testing or working on the heating cable or piping

- Following the completion of the repair work, the circuit should once again be tested (see above)
- All the important parts of the controls, thermostats, etc. must be checked for correct operation once a year, normally in the autumn

---

**Only for hot water temperature maintenance**

Newly installed heating cables have lower power at start-up of the installation. The nominal power will be reached after approximately 4 weeks of continuous operation

- The maintenance temperature should be 5°C to 10°C below the hot water temperature in the boiler

---

**Standard assembly times**

The actual assembly times achieved may deviate according to the conditions on site.

---

**Pipework**

Assembly of heating cable on pipes including fastening,  
standard installation: 25 m/hour

---

**Connection system**

(electrical connection)

RayClic-CE-02	2 min/pc.
RayClic-S-02/RayClic-PS-02	4 min/pc.
RayClic-T-02/RayClic-PT-02	6 min/pc.
RayClic-X-02	8 min/pc.
RayClic-E-02	1 min/pc.

---

**Heat-shrink connection system**

(electrical connection)

C25-21	15 min/pc.
E-06	5 min/pc.
CE20-01	20 min/pc.

---

**Other**

Testing, visual inspection, insulation resistance measurement (2x)	10 min/heating circuit
Connecting the heating circuit in the switch box	10 min/heating circuit

# General installation instructions

## Trouble shooting guide

<b>Fault</b>	<b>Possible causes</b>	<b>Measures</b>
<b>Circuit-breaker trips:</b>	Circuit breaker wrong type: e.g. type B instead of C:	Change to C Type
	Circuit breaker undersized	If the power supply cable permits, install a larger circuit breaker
	Circuit too long	Split the circuit on 2 circuit breakers
	Short-circuit/earth fault	Eliminate short-circuit/earth fault (cable ends should not be twisted)
	Circuit breaker faulty	Replace faulty circuit breaker
	No end seal	Install end seal
	Conductor (or cable) twisted	Untwist and install end seal
	<b>RCD residual current device trips:</b>	More than 500 m of frost protection heating cable installed per rcd
Earth fault at connection or in end seal		Rectify earth fault
Cable damaged		Repair cable where damaged
Moisture in the junction box		Eliminate moisture
<b>Pipeline does not become warm - Heating cable cold:</b>	Circuit-breaker has tripped	See section circuit breaker
	Residual current device has tripped	See section residual current device
	No mains voltage	Switch on
	Cable or cold lead not connected	Connect cable or cold lead
	Cable not inserted correctly in connection system or end seal	Insert cable according to installation instructions (fully insert cable)
<b>Water temperature is not maintained but the cable gives high output:</b>	No insulation	Insulation according to tables in design guides
	Insulation thickness insufficient	Insulation according to tables in design guides
	Insulation wet	Dry insulation
	Cold water is running from the boiler	Test boiler temperature
	Cold water is pumping through mixer tap into the hot water pipe.	Test the mixer tap
	Insulation according to tables in design guides.	

# Technical data

## Choice of accessoires

Cable type	Hot water temperature maintenance				Frost protection for pipes				Frost protection for gutters and downpipes				Snow melting for ramps, access ways, and footpaths												
	HWAT-L	HWAT-M	HWAT-R	FS-A-2X	FS-B-2X	FS-C-2X	GM-2X	8BTV-2-CT	EM2-XR	EM2-MI	EM2-CM	EM4-CW	Colour	Nominal voltage	Nominal power output (*on insulated metal pipes)	C-type circuit-breaker according to selected kit	Max. circuit length	Min. bending radius	Max. continous exposure temperature	Max. exposure temperature (power-on condition – 800 h. cumulative)	Max. dimensions in mm (W x H)	Weight	Approvals	Control units	
	HWAT-L	HWAT-M	HWAT-R	FS-A-2X	FS-B-2X	FS-C-2X	GM-2X	8BTV-2-CT	EM2-XR	EM2-MI	EM2-CM	EM4-CW	Yellow	230 VAC	7 W/m at 45°C	max. 20 A	max. 20 A	180 m 20 A	10 mm	65°C	85°C	13.8 x 6.8	0.12 kg/m	QWT-04	HWAT-ECO
													Orange	230 VAC	9 W/m at 55°C	max. 20 A	100 m 20 A	10 mm	65°C	85°C	13.7 x 7.6	0.12 kg/m	HWAT-ECO	HWAT-ECO	
													Red	230 VAC	12 W/m at 70°C	max. 20 A	100 m 20 A	10 mm	80°C	90°C	16.1 x 6.7	0.14 kg/m	HWAT-ECO	HWAT-ECO	
														230 VAC	10 W/m at 5°C	max. 16 A	150 m 16 A	10 mm	65°C	85°C	13.7 x 6.2	0.13 kg/m	AT-TS-13 AT-TS-14 RAYSTAT-CONTROL RAYSTAT-ECO	AT-TS-13 AT-TS-14 RAYSTAT-CONTROL RAYSTAT-ECO	
														230 VAC	26 W/m at 5°C	max. 16 A	105 m 16 A	10 mm	65°C	85°C	13.7 x 6.2	0.13 kg/m	AT-TS-13 AT-TS-14 RAYSTAT-CONTROL RAYSTAT-ECO	AT-TS-13 AT-TS-14 RAYSTAT-CONTROL RAYSTAT-ECO	
														230 VAC	31 W/m at 5°C 22 W/m at 40°C	max. 16 A	90 m 16 A	10 mm	95°C	95°C	12.7 x 5.3	0.13 kg/m	AT-TS-13 AT-TS-14 RAYSTAT-CONTROL	AT-TS-13 AT-TS-14 RAYSTAT-CONTROL	
														230 VAC	36 W/m in ice and 18 W/m in air at 0°C	max. 20 A	80 m 20 A	10 mm	65°C	85°C	13.7 x 6.2	0.13 kg/m	EMDR-10 HTS-D	EMDR-10 HTS-D	
														230 VAC	18 W/m in air at 0°C 36 W/m in ice at 0°C	max. 20 A	80 m 20 A	12.7 mm (at 20°C)	65°C	85°C	16.1 x 6.2	0.13 kg/m	–	–	
														230 VAC	90 W/m at 0°C	max. 50 A	85 m 50 A	50 mm	100°C	110°C	18.9 x 9.5	0.27 kg/m	VIA-DU-20	VIA-DU-20	
														230 VAC	30 W/m	max. 20 A	136 m	50 mm	250°C	250°C	min 4.8; max. 6.3	–	VIA-DU-20	VIA-DU-20	
														230 VAC	300 W/m <sup>2</sup>	max. 20 A	21 m (12.6 m <sup>2</sup> )	–	65°C	65°C	5.0 x 7.0	–	VIA-DU-20	VIA-DU-20	
														230 VAC	400 VAC	max. 20 A	–	30 mm	65°C	65°C	5.0 x 7.0	–	–	–	

### Connection system

Connection system	Junction box	Connection kit	Support bracket
	–	RayClick	included in the kit
	–	RayClick	included in the kit
	–	RayClick	included in the kit
	JB 16-02	CE20-01	JB-SB-08
	–	RayClick	included in the kit
	JB 16-02	CE25-21 E-06	JB-SB-08
	VIA-JB-2	VIA-CE1	–
	VIA-JB-2	Pre-installed	–
	VIA-JB-2	–	–

Approvals: BS/ÖVE/ERFA/CE