Installation Guide

Expansion Module 3 (EM3)

For light commercial heat pumps with Genesis control platform

www.thermia.com

Thermia AB is not liable or bound by warranty if these instructions are not adhered to during installation or service.

The English language is used for the original instructions.
Other languages are a translation of the original instructions.
(Directive 2006/42/EC)

Table of Contents

1 Important information/Safety instructions

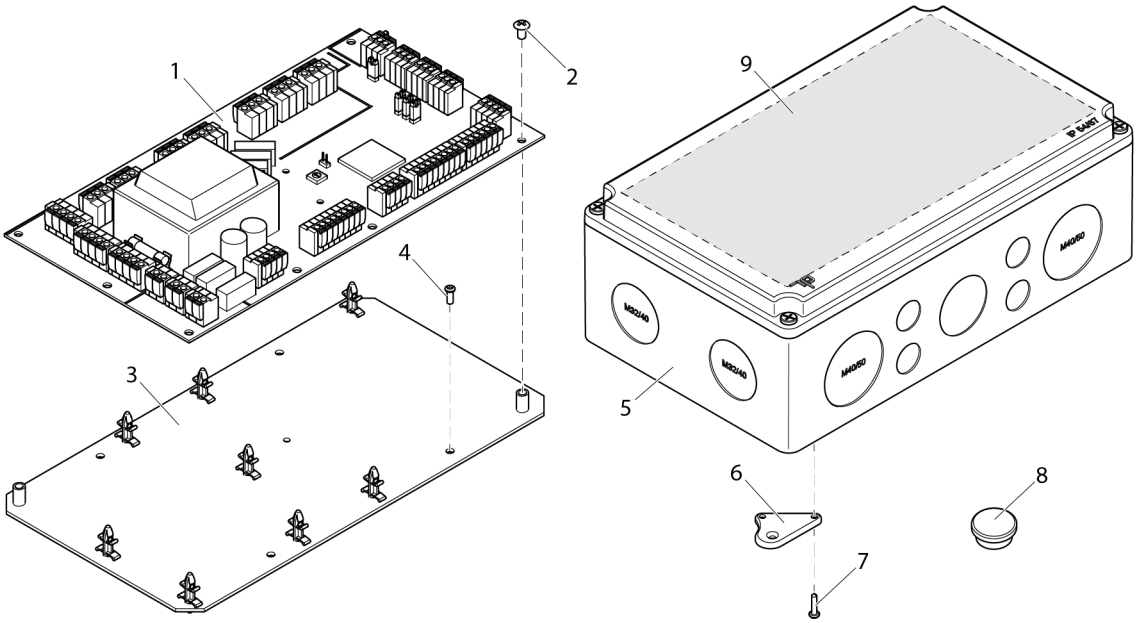
1.1 Safety precautions

Danger 	Hazardous electrical voltage! The terminal blocks are live and may cause death through electric shock. All power supplies must be isolated before electrical installation is started.
Warning 	Before making any electrical work, turn off the power supply connected to the heat pump.
Warning 	Electrical installation may only be carried out by an authorized electrician and must follow applicable local and national regulations (IEC 60335-2-40).
Warning 	Risk of personal injury! Children are not permitted to play with the product.

2 Components and dimensions

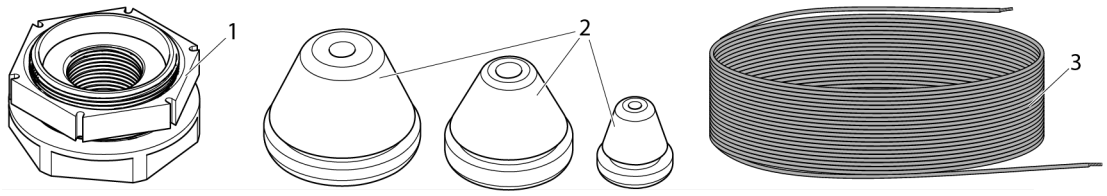
2.1 Components and hardware

Components included in kit:



1. EM3 card
2. Mounting screws EM3 card
3. Mounting plate (preinstalled in enclosure with spacer supports)
4. Screws for mounting plate
5. Enclosure
6. Mounting brackets
7. Screws for mounting brackets
8. Sealing plugs
9. Wiring decal

Required/optional components not included:



1. Enclosure connectors (optional)
2. Sealing plugs
3. Power and signal cables

3 Installation

3.1 General information

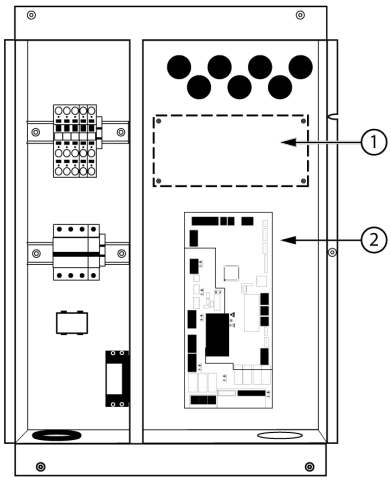
General information

The EM3 module can be installed internally inside the heat pump or externally in a separate enclosure.

Installation must be made in an indoor environment.

3.2 Internal installation

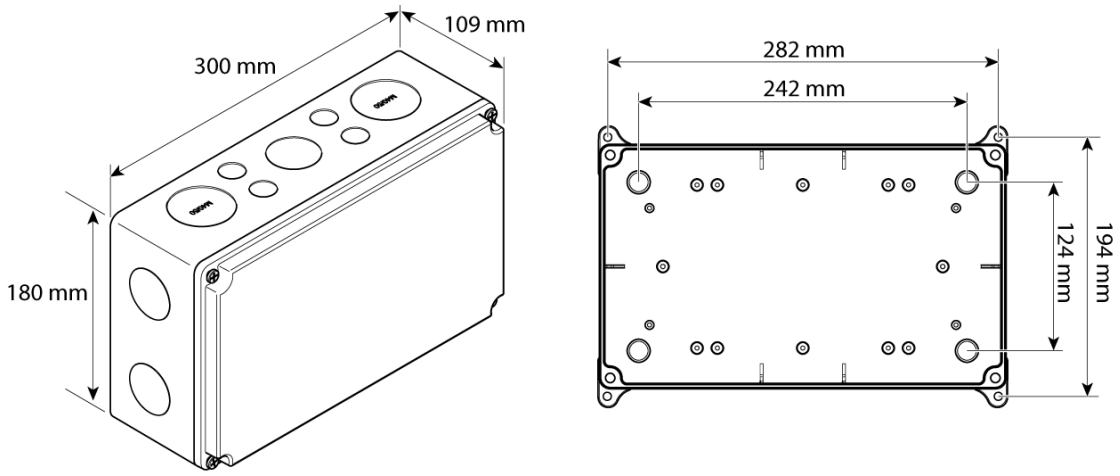
For internal installation of EM3, see the below picture of the electrical cabinet in the heat pump for correct placement.
Follow the instructions in the chapter regarding connecting power supply and Modbus communication to set up EM3 with the BM-card.



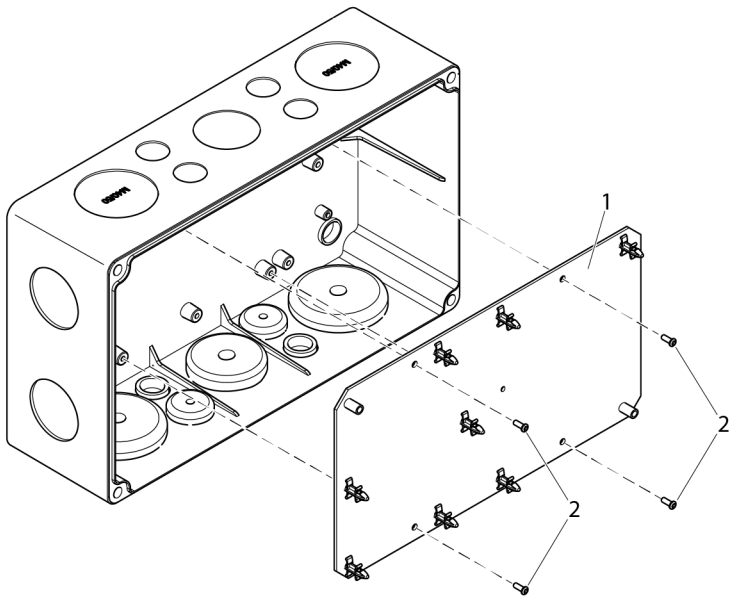
1. Placement for EM3
2. BM-card

3.3 External installation

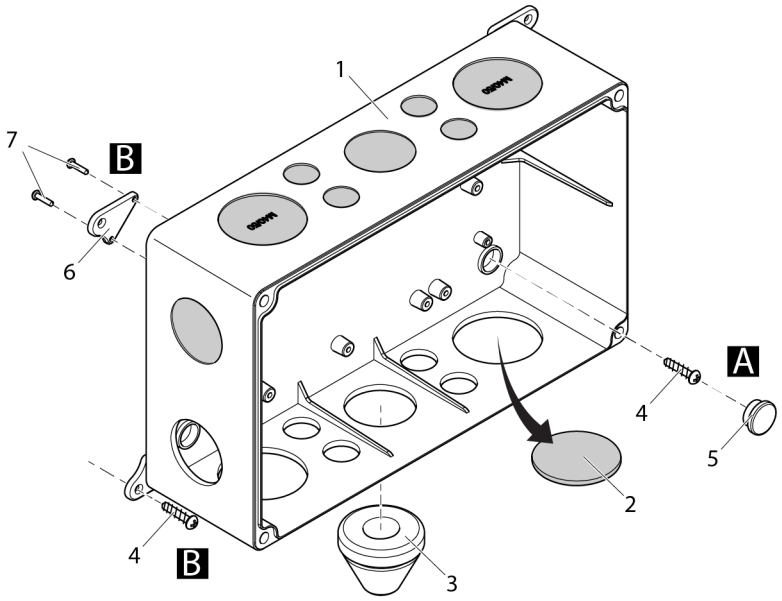
3.3.1 Enclosure



The enclosure can be mounted to the wall by putting the screws through the back plane of the enclosure (marked positions inside the enclosure) or by using the mounting brackets on the corners of the enclosure.

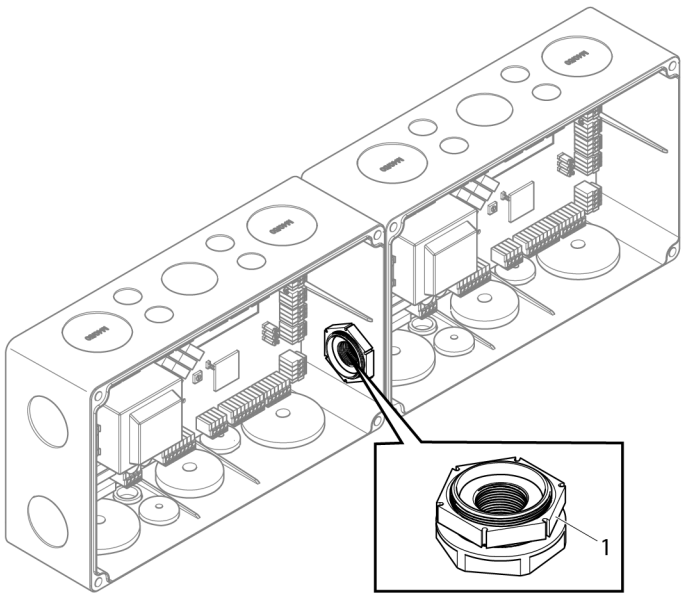


1. Mounting plate
2. Screw



1. Enclosure
2. Knock out panel
3. Sealing plug
4. Screw
5. Sealing plug for screw holes
6. Mounting bracket
7. Screw for mounting bracket

If more than one enclosure is to be used for the installation it is possible to interconnect a number of enclosures with couplers (not included).

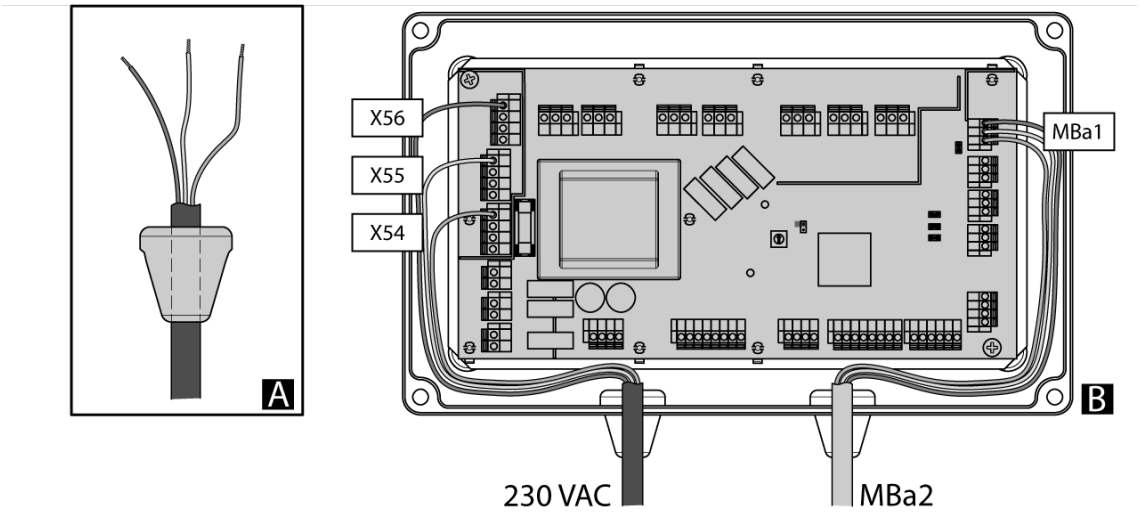


1. Enclosure connector

3.3.2 Wiring, mounting plate and EM3

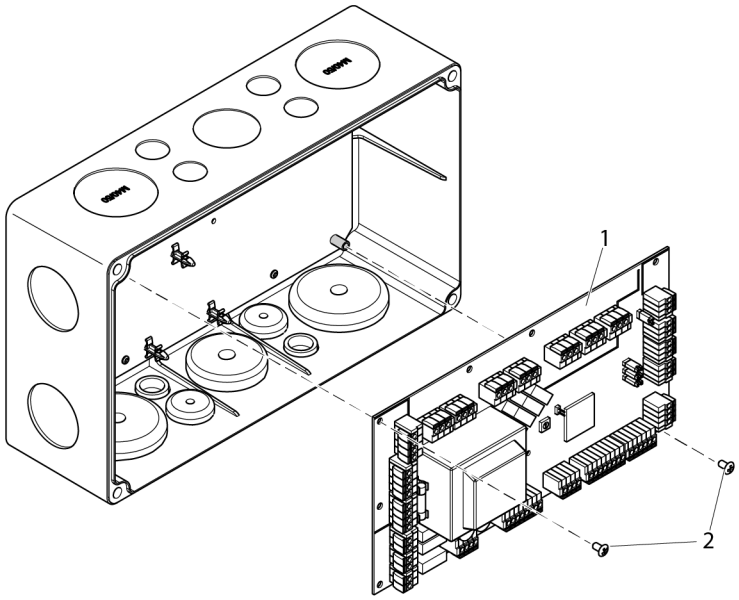
1. Remove the knock out panels as required for routing the wiring into the enclosure.

2. Put sealing plugs on the cables and route all cables into the enclosure. Cut away the outer insulation layer on the cables just inside the enclosure to facilitate easier routing and connection ot the wires to the EM3 unit terminals. Make sure you leave enough wire length inside the enclosure to ensure tension free connections on the EM3 terminals and press the sealing plugs into the holes in the enclosure.



A. Cut the outer insulation just inside of the enclosure.
B. Leave enough wire length to ensure tension free connections.

3. Fit the EM3 unit onto the plastic PCB spacer supports on the mounting plate and press down on the EM3 unit so that the spacer supports locks on to the circuit board. Secure the EM3 unit to the mounting plate with the two screws.



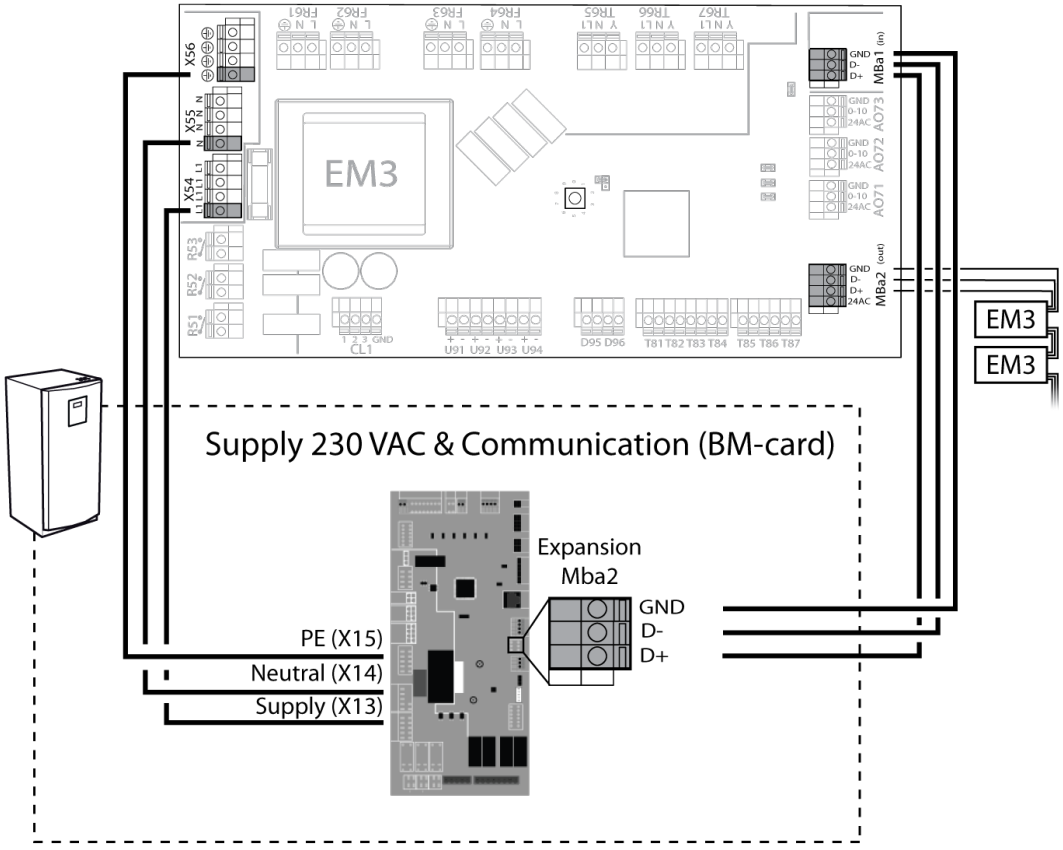
1. EM3 unit
2. Screw

4. The function switch in the center of the EM3 unit is by default set to the 0 (zero) position and the jumper switch to the right of it is set to open position (jumper is not mounted on both pins).

Only in Legacy configurations (ID:10-17) should the jumper be mounted on both pins!

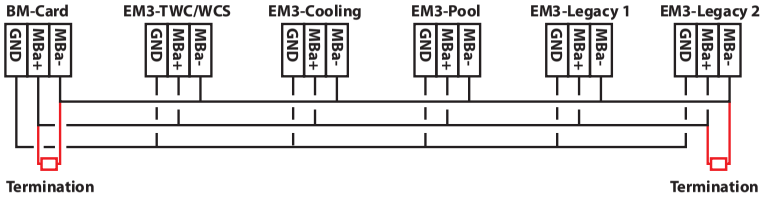
Make sure the function switch correlates with the same ID number as the respective function that is configured with the EM3. Connect the power supply wires between **X54-X56 (EM3)** and **X13-X15 (BM-card)**. Connect the Modbus wires between **MBa1 (EM3)** and **Expansion Mba2 (BM-card)** as shown in the picture below.

In the event of more than one EM3-card active in the same installation, connect the communication wires from **MBa2 (EM3)** on the first card to **MBa1 (EM3)** on the second card, etc. As shown in the picture below.

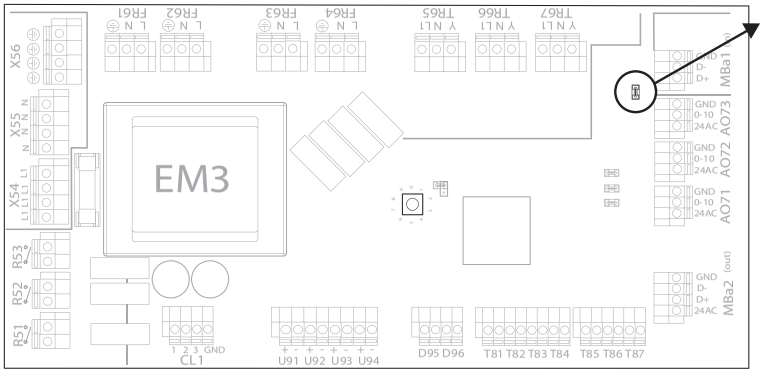


5. Termination of a communication network is needed whenever the Modbus connection is used. This to ensure that the receiver is getting the maximum signal power, by matching the characteristic impedance of the cabling using termination jumpers on each end of the communication network.

Below is a schematic example of a series of accessories and where to put the termination jumpers accordingly:



Locate the termination jumper on the EM3-card from the below picture:



The jumper is activated on the EM3-card

The jumper is NOT activated on the EM3-card

4 Supported functions

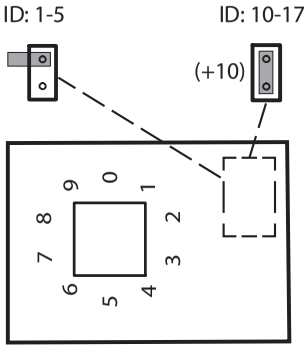
4.1 Supported functions

Max load on 230V feeding relays (marked "FR..") or potential free relays (marked "R..") is 230W with normal motors. Max 850W with soft starting loads.
Max total load on EM3 is 5A.
Max load on TRIAC output (marked "TR") = 10VA
Total max load on 24V supply to supply mixing valve actuators: 21VA

IMPORTANT! Requires Genesis software version 7.01 or later. Please note that a restart of the control system is required for the installation to establish communication between the heat pump and the Expansion module. This is indicated by the following icon in the display top bar (the same symbol is used in "Operating mode" in the display to execute a restart):

List of supported functions:

- ID:1 TWC/WCS
- ID:2 Distribution circuit 2 & 3
- ID:3 Distribution circuit 4 & 5
- ID:4 Cooling
- ID:5 Pool
- ID:10-17 Legacy (Jumper MUST be on both pins as shown in the picture to the right)
- Control of internal brine pumps (only available with ID:1-5)
- Start of external brine pump, 0-10V (Used with ID:1)

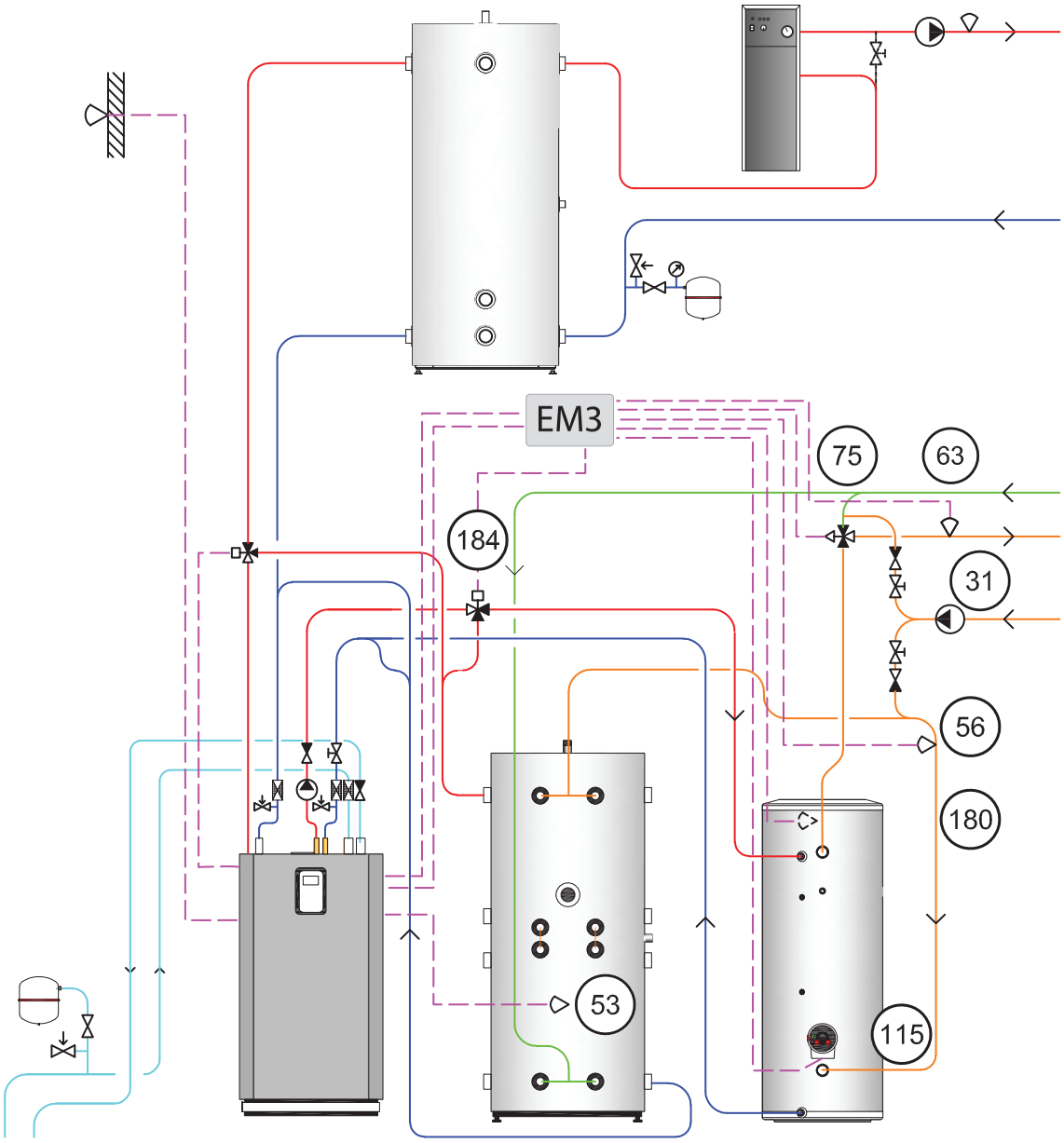


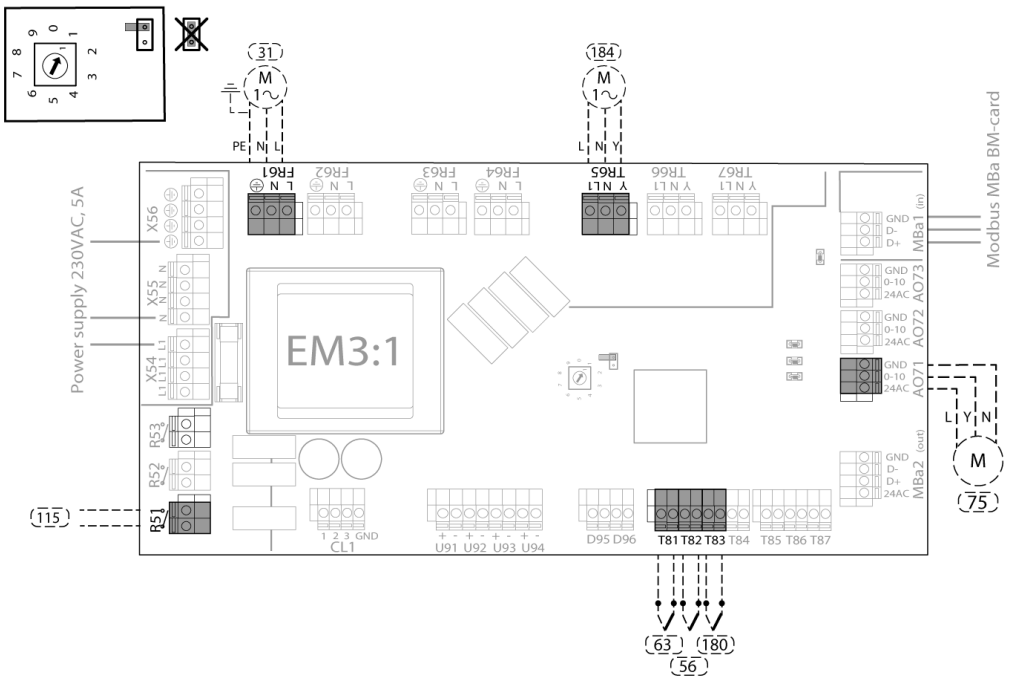
Glossary for abbreviations printed on the EM-card:

- **X**: Power supply (in and out, 230VAC)
- **R**: Potential free relay
- **FR**: Feeding relay (230VAC)
- **TR**: TRIAC output (230VAC)
- **MBa1**: ModBus communication in
- **MBa2**: Modbus communication out
- **AO**: Analogue out
- **CL**: Current limiter
- **U**: Universal input (analogue/digital)
- **D**: Digital input
- **T**: Temperature sensor input (PT1000)
- **Funktions ID**: ID selector
- **MBa TERM**: Termination jumper

4.1.1 Function ID: 1, TWC/WCS

TWC





TWC

Table item number	Terminal	Description	TWC
31	FR61	Circulation pump (HWC)	X
56	T82	Sensor HWC return line	X
63	T81	Sensor hot water	X
75	AO71	Mixing valve HW	X
115	R51	Auxiliary heater hot gas boiler	X
180	T83	Tank sensor TWC (hot gas boiler)	X
184	TR65	Reversing valve hot gas boiler	X

TWC - Tap Water Control
The TWC function regulates the temperature in the end tank and the outgoing hot water (mixing valve (75) is required).
The mixing valve keeps the desired set value on the outgoing hot water.
An auxiliary heater (115) can be activated/deactivated if the temperature in the end tank (180) goes above or under the set value.
The HWC circulation pump (31) is in constant drive and the Sensor HWC return line (56) is used only for monitoring.

TWC with hot gas functionality
This function is used to switch the hot gas charge (184) between the end tank and the storage tank (requires an installed hot gas pump and that hot gas is activated in the display).
When the temperature in the end tank exceeds the set value (default 80°C), the storage tank is connected.
The mixing valve switches back if:

- the end tank goes below 70°C
- or if the temperature goes below the stop temperature for TWC + 3°C (to avoid starting the auxiliary heater)
- or if the temperature in the storage tank gets higher than 85°C

Commission after installation:

1. Login: Press padlock, 607080 and confirm
2. Go to SETTINGS/INSTALLATION and activate TWC and Hot Gas
3. Go to SETTINGS/TWC and enable TWC
4. Go to SETTINGS/HOT GAS and enable Hot gas and directional valve function

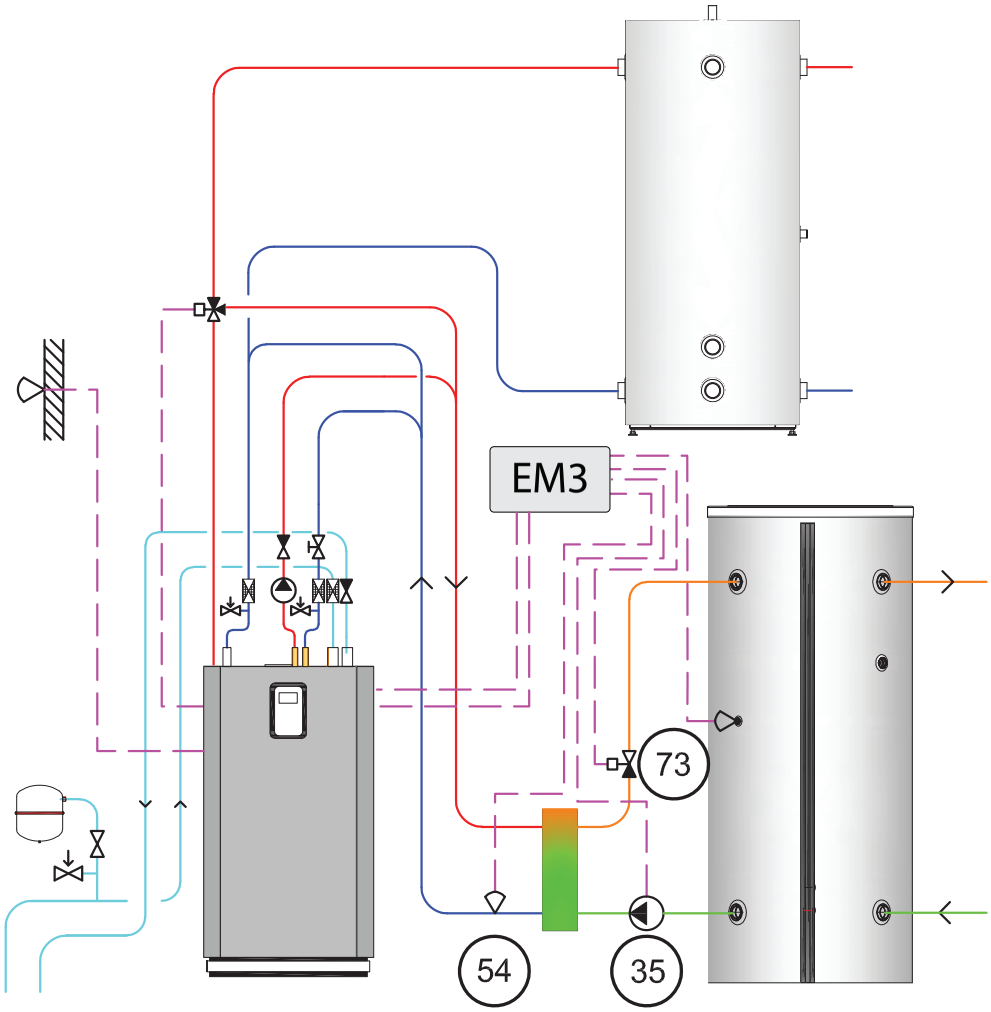
5. Make desired settings and save
6. Restart the heat pump and check functionality

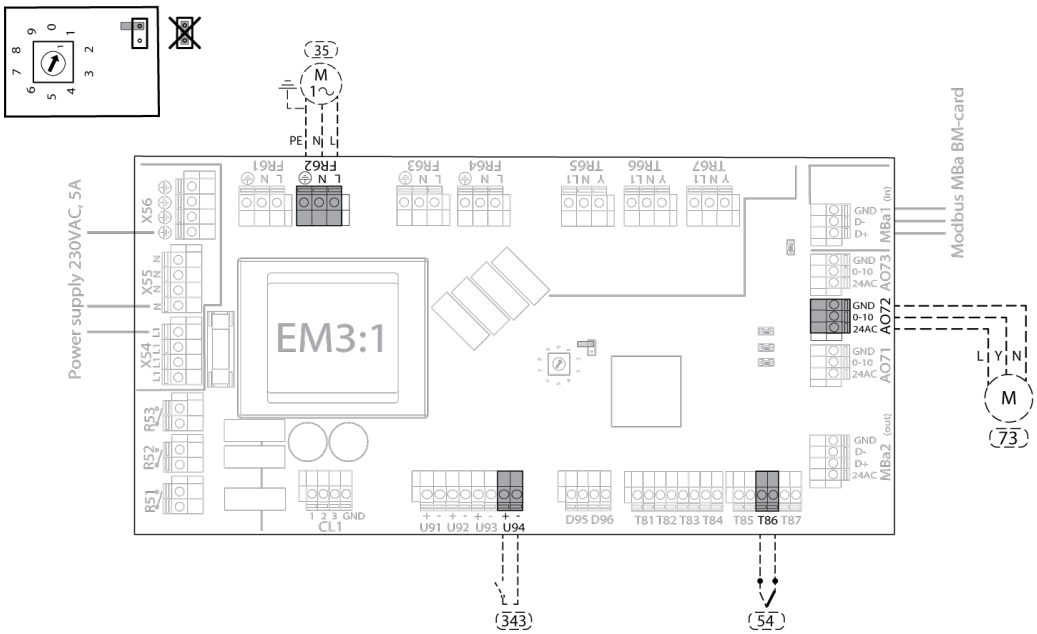
TWC - Antilegionella
With the TWC the antilegionella function is scheduled to activate the auxiliary heater in the end tank, whenever the demand for antilegionella is active.

Commission after installation:

1. Login: Press padlock, 607080 and confirm
2. Go to SETTINGS/INSTALLATION and activate TWC
3. Go to SETTINGS/TWC and turn on function
4. Make desired settings and save
5. Restart the heat pump and check functionality

WCS - Water Charge System





WCS

Table item number	Terminal	Description	WCS
35	FR62	Circulation pump (WCS)	X
54	T86	Sensor (WCS)	X
73	AO72	Control valve WCS	X
343	U94	External WCS start	X

WCS - Water Charge System

The WCS function controls the hot water tank charge temperature by regulating the return line temperature (54) when hot water production is active. When hot water production is active the circulation pump (35) will run and the mix valve will regulate the return line temperature (54) according to the desired temperature setpoint. The valve will close if the temperature at (54) drops and reversed if the temperature rises. Minimum opening degree for the **Control valve WCS** (73) is set default to 15% and can be changed in the display.

Commission after installation:

1. Login: Press padlock, 607080 and confirm
2. Go to SETTINGS/INSTALLATION and activate WCS
3. Go to SETTINGS/WCS and turn on function
4. Make desired settings and save
5. Restart the heat pump and check functionality

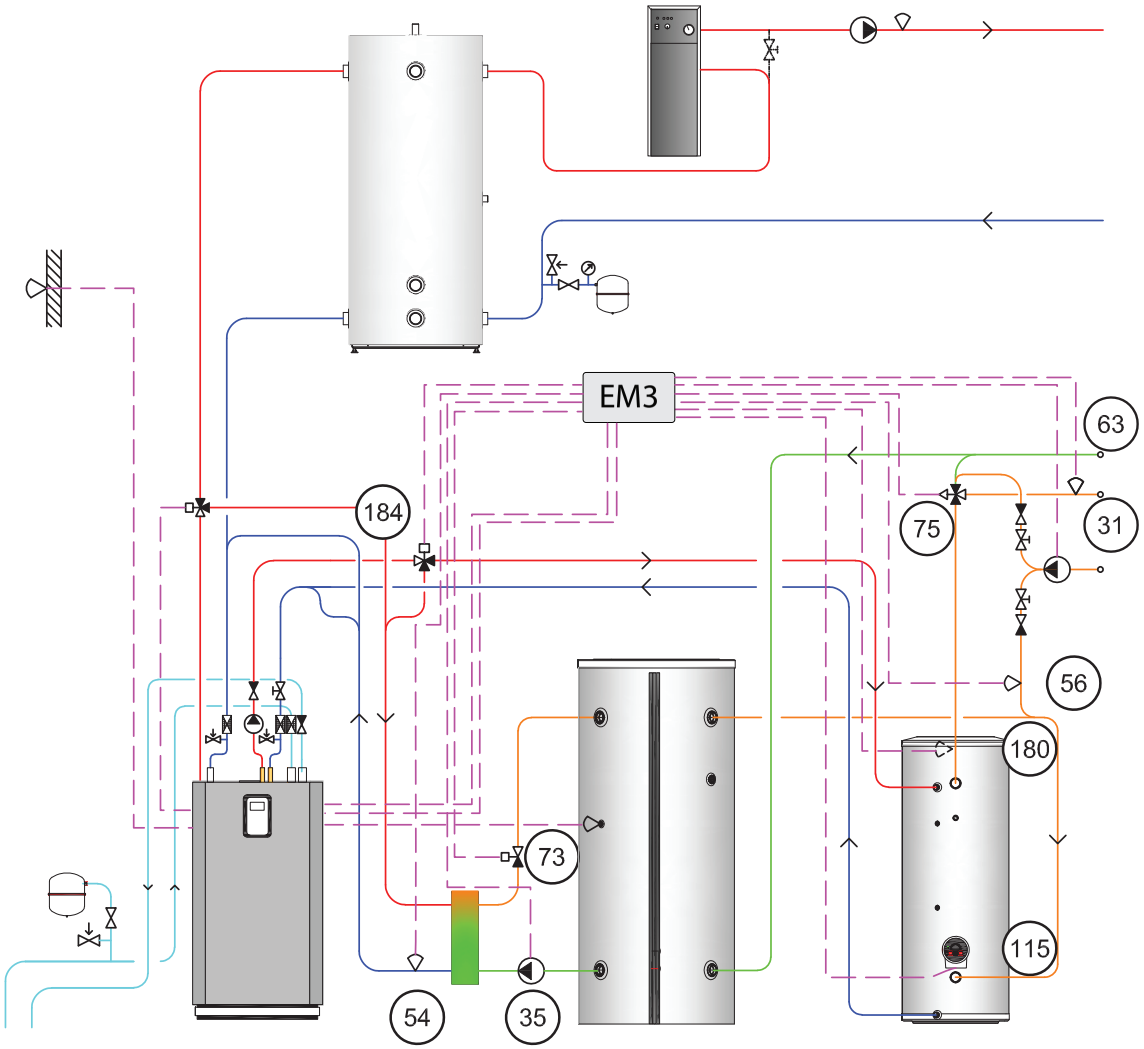
WCS with hot gas circuit

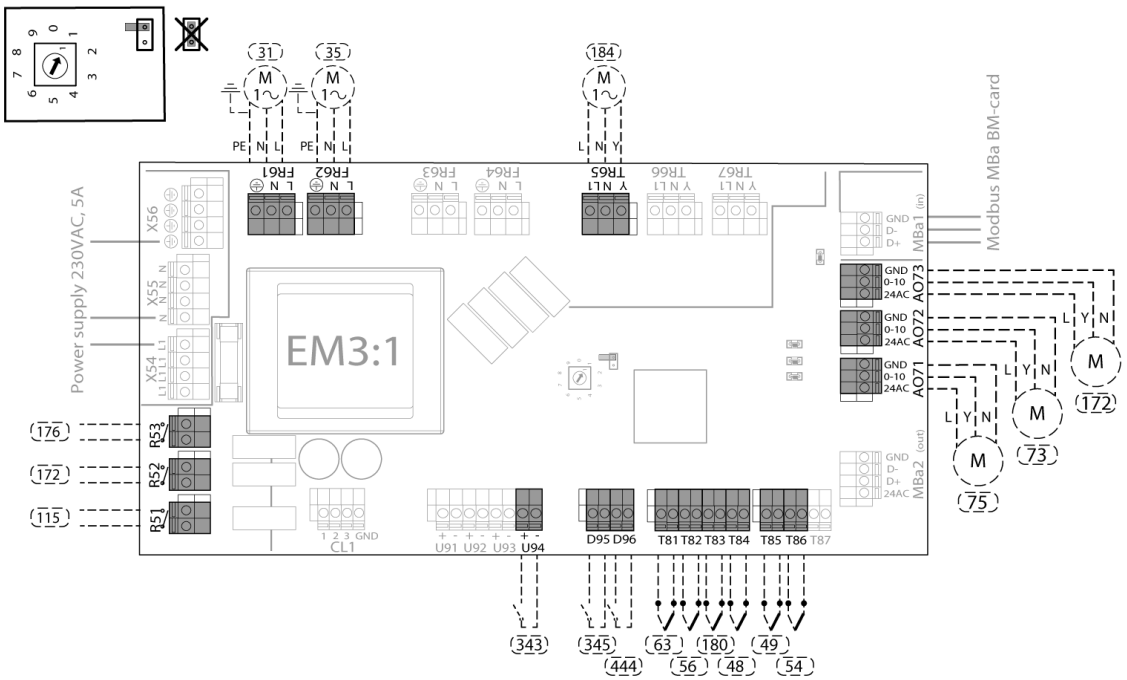
The WCS hot gas function is used for charging the hot water with the hot gas circuit when a regular hot water tank production does not run. The WCS function starts when a hot gas pump is running. In a primary/secondary system solution the hot gas pumps on the secondaries are also considered. The WCS function stops when all hot gas pumps in the system has stopped running.

Commission after installation:

1. Login: Press padlock, 607080 and confirm
2. Go to SETTINGS/INSTALLATION and activate WCS
3. Go to SETTINGS/INSTALLATION and activate Hot gas
4. Go to SETTINGS/HOT GAS and enable Hot gas
5. Go to SETTINGS/WCS and enable WCS and turn on the WCS hot gas function
6. Make desired settings and save
7. Restart the heat pump and check functionality

WCS and TWC (with hot gas functionality)





WCS and TWC

Table item number	Terminal	Description
31	FR61	Circulation pump (HWC)
35	FR62	Circulation pump (WCS)
48	T84	Sensor external brine in
49	T85	Sensor external brine out
54	T86	Sensor (WCS)
56	T82	Sensor HWC return line
63	T81	Sensor hot water
73	AO72	Control valve WCS
75	AO71	Mixing valve HW
115	R51	Auxiliary heater hot gas boiler
172	R52	Auxiliary circulation pump (brine)
172	AO73	Auxiliary circulation pump (brine)
176	R53	External heater burn out pump (Dynamic allocation I/O)
180	T83	Tank sensor TWC (hot gas boiler)
184	TR65	Reversing valve hot gas boiler
343	U94	External WCS start
345	D95	Start internal brine
444	D96	External alarm (Dynamic allocation I/O)

WCS and TWC (with hot gas functionality)

WCS with hot gas charge and end tank (TWC).

This function is used to charging hot water via the hot gas circuit into an end tank when ordinary hot water production is not active. The hot gas circuit will charge the end tank as long as the temperature in the end tank has not reached the maximum allowed temperature (adjustable in the display).

When the maximum allowed temperature is reached, the reversing valve for the hot gas boiler (184) shifts to charge the storage tank via the WCS valve. When the valve for hot gas shifts, the WCS control starts to charge the storage tank with the hot gas circuit.

Functions needed to be activated:

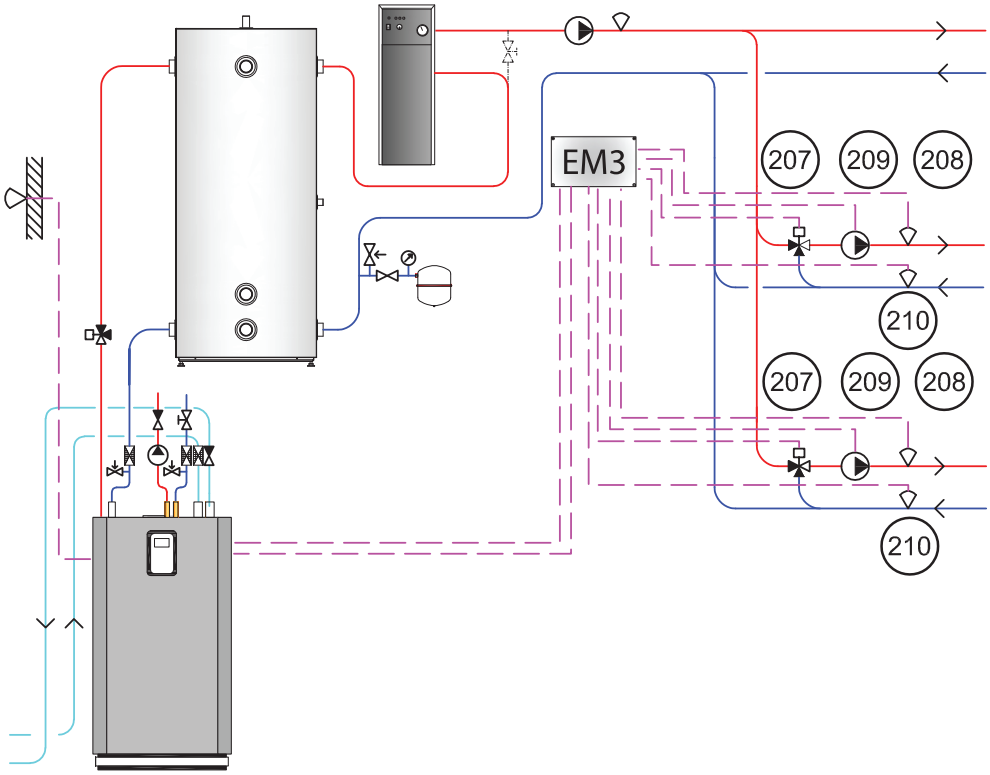
- WCS
- TWC
- WCS hot gas functionality (activated in the WCS menu in the display)
- Hot gas (activated in the hot gas menu in the display)

Commission after installation:

1. Login: Press padlock, 607080 and confirm
2. Go to SETTINGS/INSTALLATION and activate WCS
3. Go to SETTINGS/INSTALLATION and activate TWC
4. Go to SETTINGS/INSTALLATION and activate Hot gas
5. Go to SETTINGS/WCS and enable WCS and turn on the WCS hot gas function
6. Go to SETTINGS/HOT GAS, enable Hot gas and activate Reversing valve hot gas enable
7. Make desired settings and save
8. Restart the heat pump and check functionality

4.1.2 Function ID: 2, DC 2-3

Distribution circuit 2 (example)



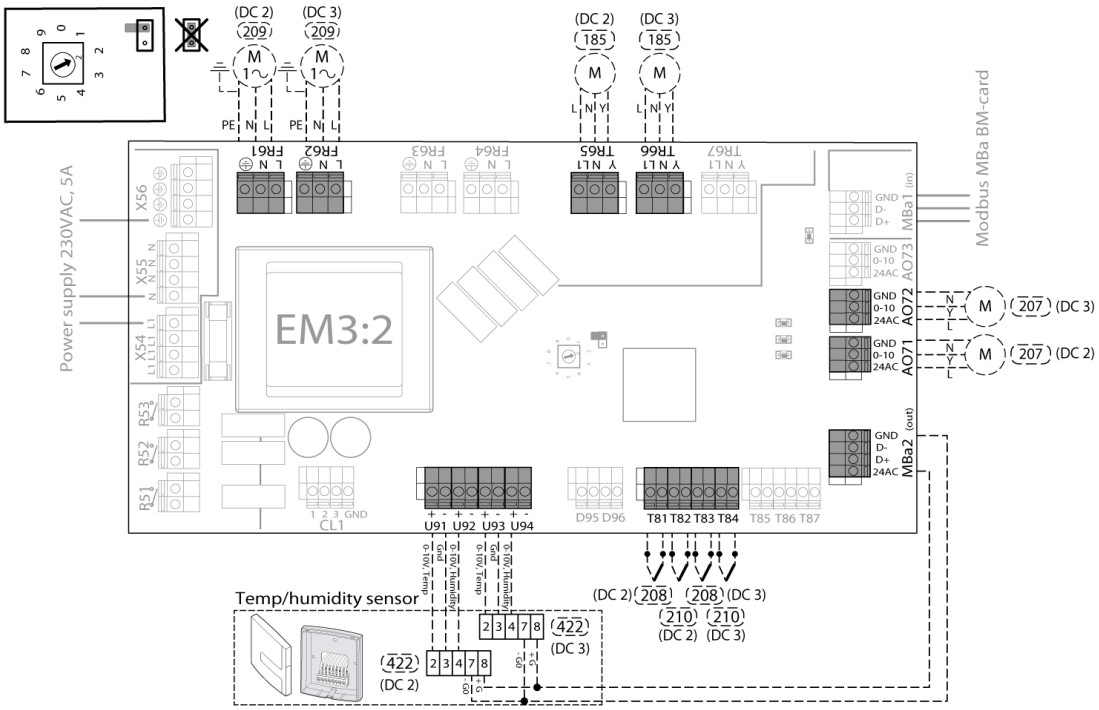


Table item number	Terminal	Description
185	TR65	Reversing valve cooling mode (distribution circuit 2)
185	TR66	Reversing valve cooling mode (distribution circuit 3)
207	AO71	Shunt (distribution circuit 2)
207	AO72	Shunt (distribution circuit 3)
208	T81	Supply line sensor (distribution circuit 2)
208	T83	Supply line sensor (distribution circuit 3)
209	FR61	Circulation pump (distribution circuit 2)
209	FR62	Circulation pump (distribution circuit 3)
210	T82	Return line sensor (distribution circuit 2)
210	T84	Return line sensor (distribution circuit 3)
422 —> Mba2	U91(+/-), U92(+)	Dewpoint sensor (temp/humidity) (distribution circuit 2)
422 —> Mba2	U93(+/-), U94(+)	Dewpoint sensor (temp/humidity) (distribution circuit 3)

Distribution circuits 2-3

In heating systems where there is a need of a separately controlled heating circuit (in addition to the open main circuit) with a lower heat curve, it is possible to control a separate circuit (mixing valve (207), temperature sensor (208) and circulation pump (209)) with a lower set heat curve.

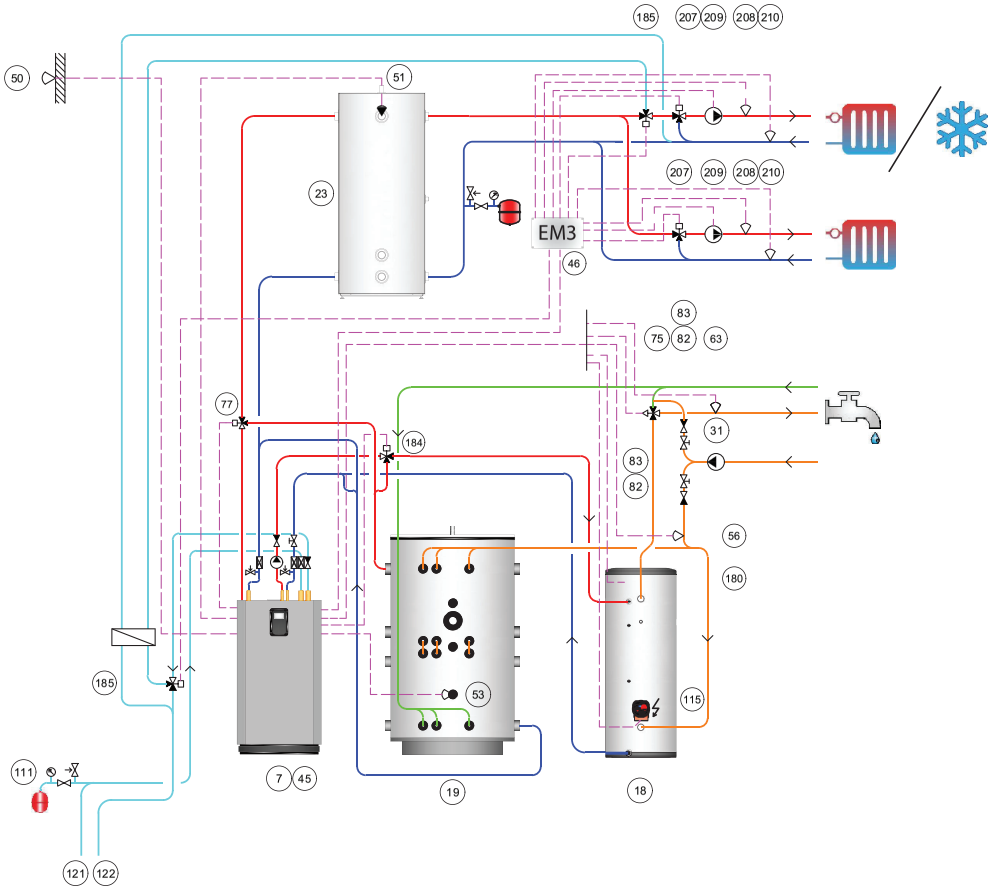
Distribution circuits 2-5 are used for distributing heating or cooling. Choose which function to support in the display.
It is possible to connect a room sensor to control the temperature for either heating or cooling function (sold as separate accessory). If used with a cooling functionality it is possible, and advisable, to also connect a dewpoint sensor (422).

Commission after installation:

1. Login: Press padlock, 607080 and confirm
2. Go to SETTINGS/INSTALLATION and activate Distribution circuit 2/3
3. Go to SETTINGS/MIX VALVES and turn on the function for the distribution circuit that is installed
4. Make desired settings and save
5. Restart the heat pump and check functionality

Distribution circuits with cooling functionality

With Distribution circuits 2-5 there is also possible to control a temperature sensor (108), a circulation pump (109) and shunt valve (107) for cooling. The shunt then regulates towards a fixed temperature (can be adjusted in the display).
There is also an automatic mode that can be activated. In this mode, the shunt automatically adjusts itself between heating and cooling, depending on the season. A relay output (185) is activated when in cooling season and deactivated when in heating season.



4.1.3 Function ID: 3, DC 4-5

For system solutions and setup, see Distribution circuit 2-3

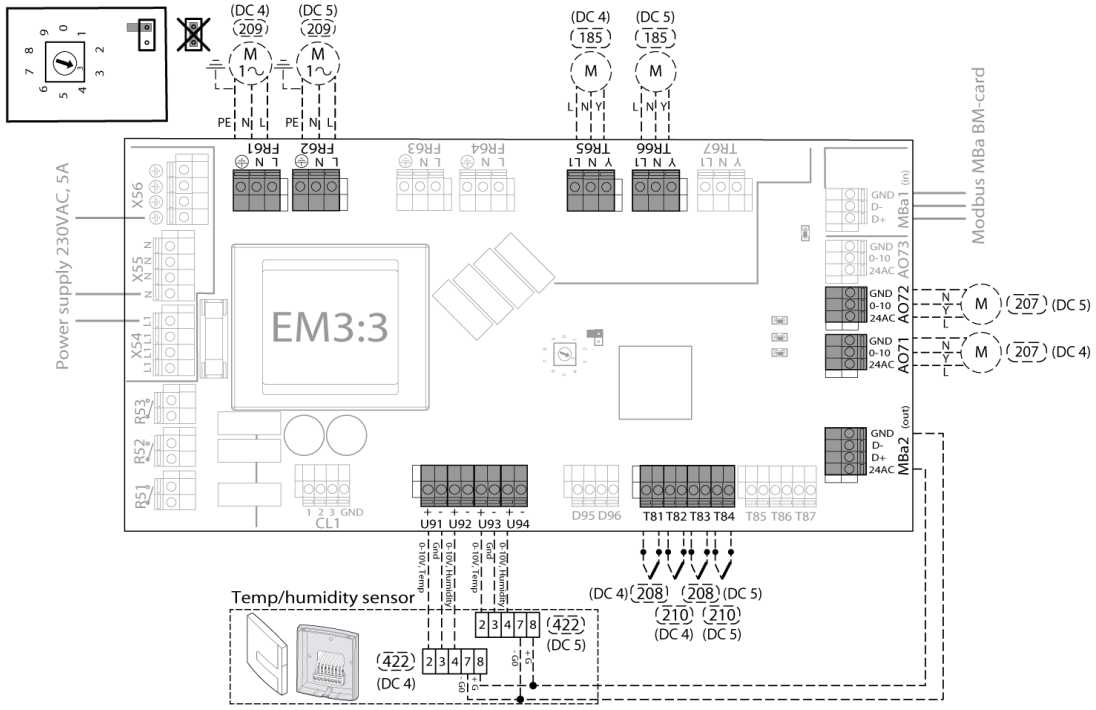
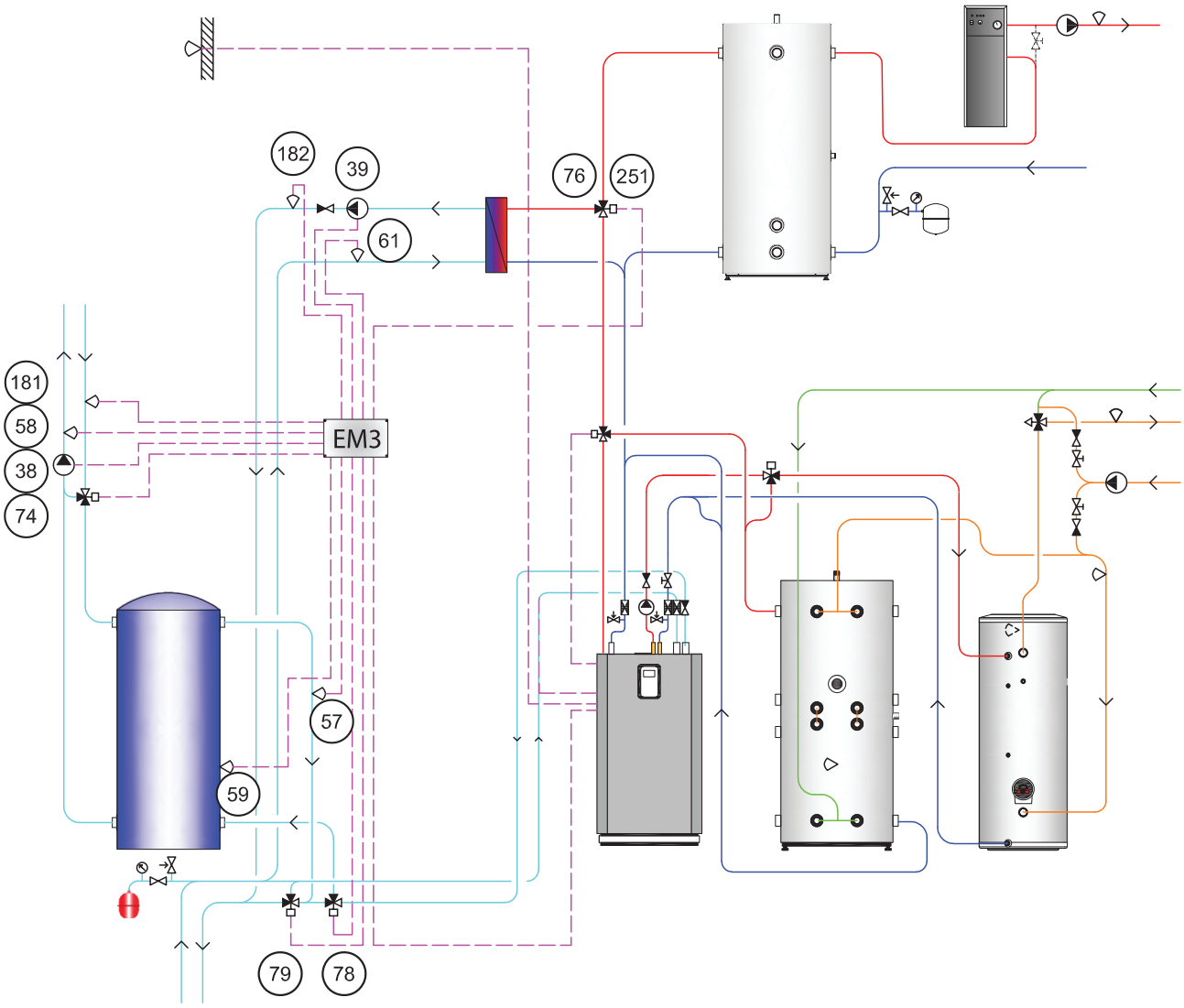


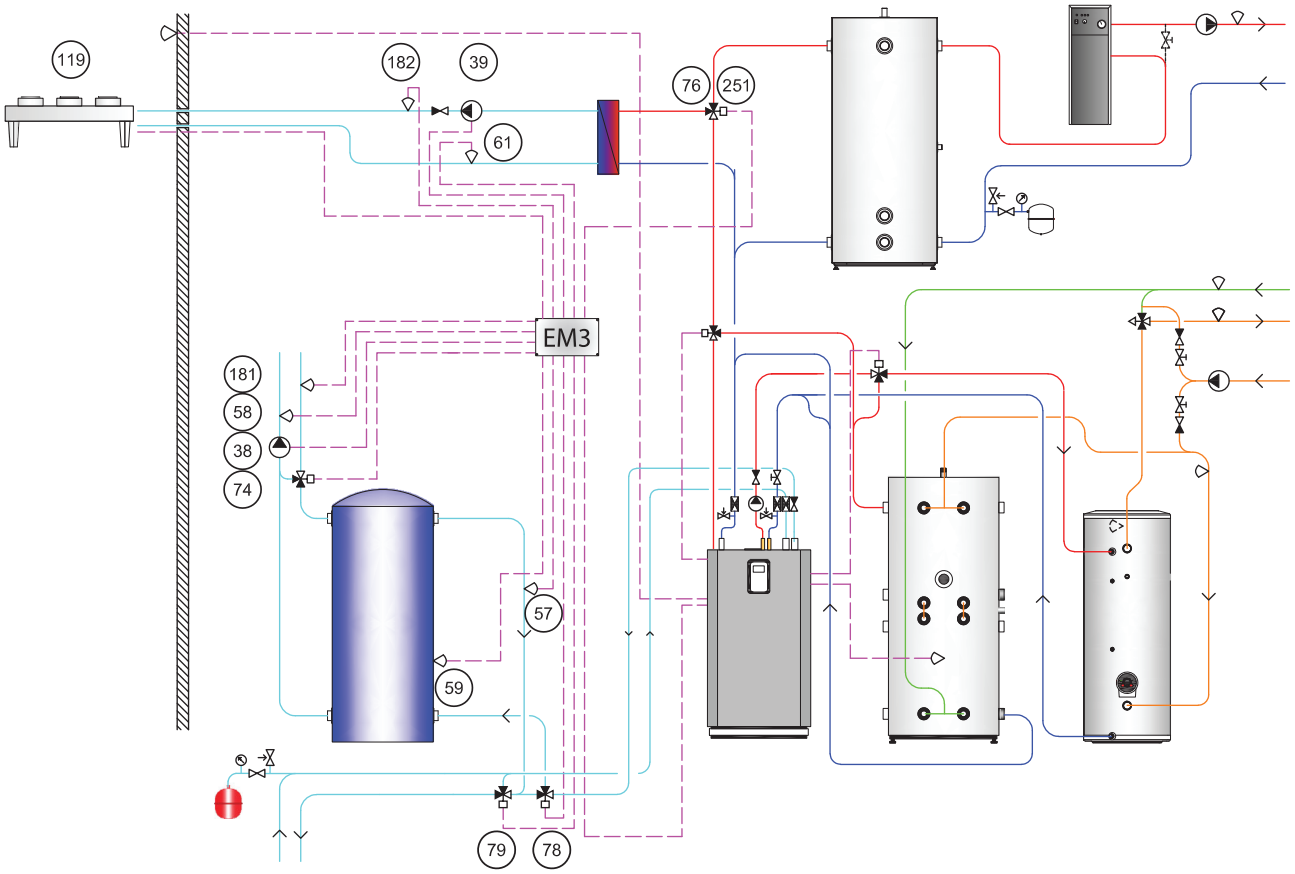
Table item number	Terminal	Description
185	TR65	Reversing valve cooling mode (distribution circuit 4)
185	TR66	Reversing valve cooling mode (distribution circuit 5)
207	AO71	Supply line sensor (distribution circuit 4)
207	AO72	Supply line sensor (distribution circuit 5)
208	T81	Supply line sensor (distribution circuit 4)
208	T83	Supply line sensor (distribution circuit 5)
209	FR61	Circulation pump (distribution circuit 4)
209	FR62	Circulation pump (distribution circuit 5)
210	T82	Return line sensor (distribution circuit 4)
210	T84	Return line sensor (distribution circuit 5)
422 —> Mba2	U91(+/-), U92(+)	Dewpoint sensor (temp/humidity) (distribution circuit 4)
422 —> Mba2	U93(+/-), U94(+)	Dewpoint sensor (temp/humidity) (distribution circuit 5)

4.1.4 Function ID: 4, Cooling

Cooling towards borehole



Cooling towards chiller



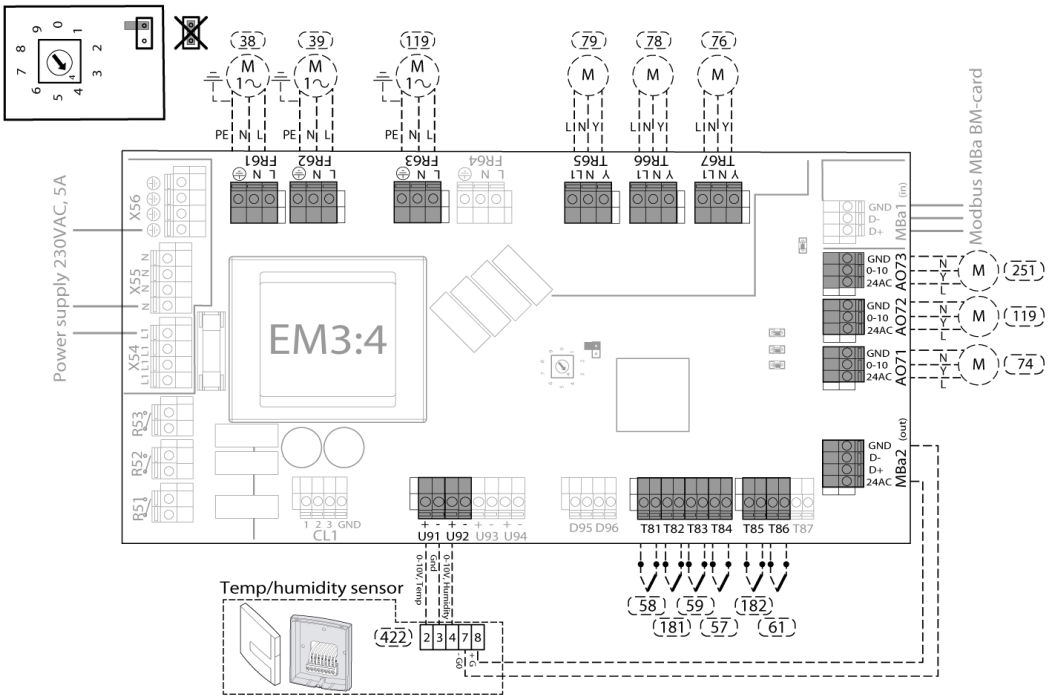


Table item number	Terminal	Description
38	FR61	Circulation pump (cooling circuit)
39	FR62	Circulation pump (heat dump)
57	T84	Return line sensor cooling tank
58	T81	Supply line sensor cooling circuit
59	T83	Sensor cooling tank
61	T86	Return line sensor heat dump
74	AO71	Shunt valve cooling circuit
76*	TR67	Reversing valve heat dump
78	TR66	Reversing valve cooling
79	TR65	Reversing valve active cooling
119	FR63	Control signal dry cooler
119	AO72	Control signal dry cooler
181	T82	Return line sensor (cooling circuit)
182	T85	Supply line sensor heat dump
251*	AO73	Shunt valve heat dump
422 —> Mba2	U91(+/-), U92(+)	Dewpoint sensor

* **Reversing valve heat dump** (76) OR **Shunt valve heat dump** (251) is used in this position.

Cooling (passive/active)

With the Passive/active cooling function, the heat pump can control and produce passive cooling when the brine temperatures are sufficiently low, but also actively use the compressor to produce active cooling (and dump excess heat to brine or a surplus chiller if no other heat demand is active.

Controls:

- Shunt valve cooling circuit (74)
- Circulation pump (cooling circuit) (38)
- Reversing valve cooling (78)
- Reversing valve active cooling (79)
- Reversing valve heat dump (76) **or** Shunt valve heat dump (251)
- Control signal dry cooler (119)

Cooling

The **Shunt valve cooling circuit** (74) is regulated to keep a fixed desired value for the supply line temperature out on the system. The valve opens to decrease/cool if the outgoing supply line temperature rises, and it will increase/heat if the supply line temperature falls. If the dewpoint function is activated (requires an installed dewpoint sensor), this is calculated based on the indoor room temperature and the relative dewpoint. The highest desired value of set room temperature and dewpoint plus 2°C becomes the desired value for the **Shunt valve cooling circuit** (74). **Circulation pump (cooling circuit)** (38) runs according to seasonal stop or permanent settings.

Passive cooling: If the **Sensor cooling tank** (59) temperature goes over the set value, the **Reversing valve cooling** (78) is activated and the brine fluid circulates through the cooling tank and back to the bore hole or collector circuit.

Active cooling: If the **Sensor cooling tank** (59) is warmer than the bore hole temperature, the **Reversing valve active cooling** (79) is activated when the temperature in the cooling tank is unable to go below the desired temperature of the **Sensor cooling tank** (59). The compressor will then start to execute active cooling. The energy uptake is removed from the borehole and the heat pump now draws the energy from the cooling tank.

Heat dump to bore hole or Control signal dry cooler (chiller) (119)

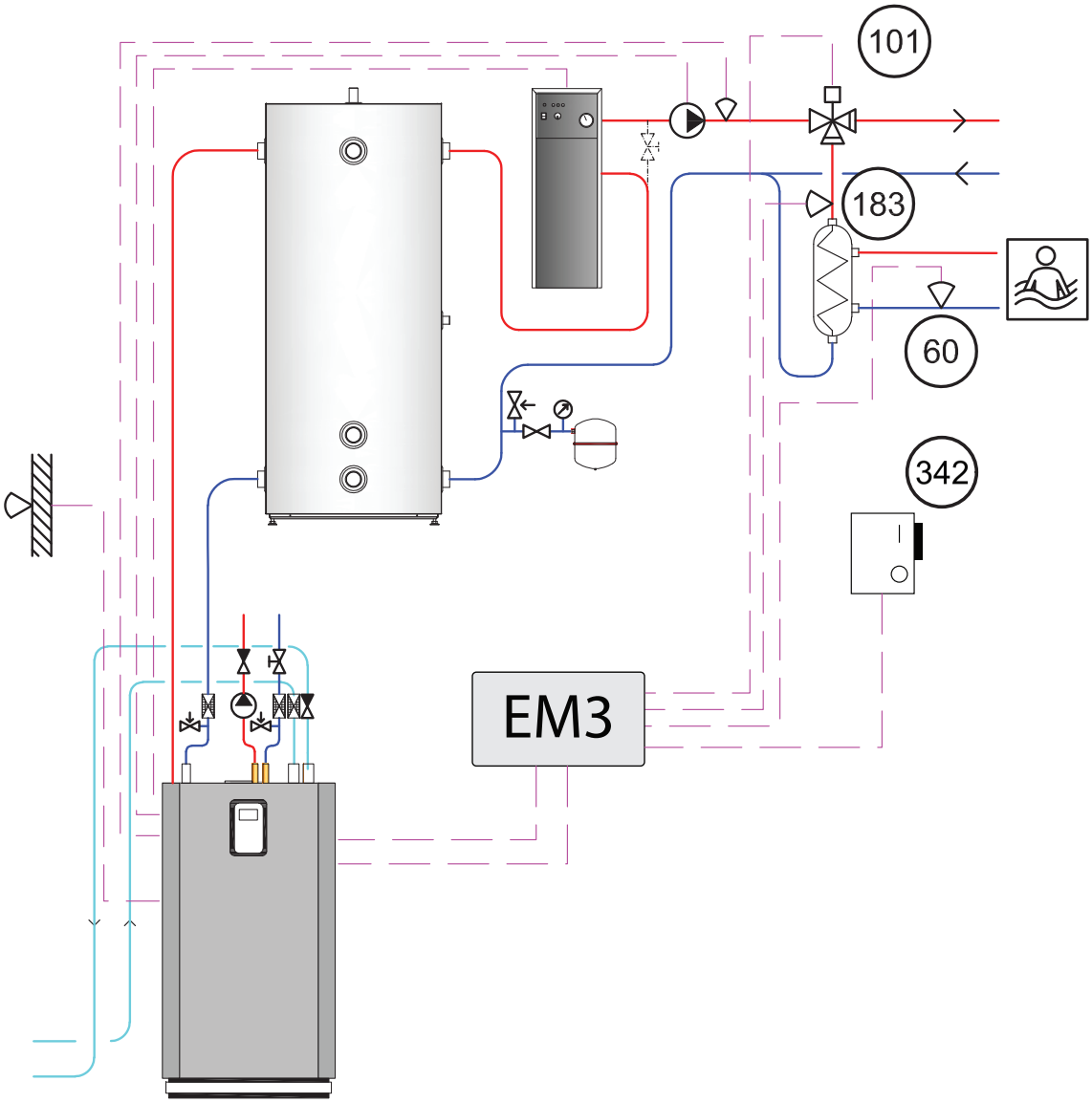
In the need of energy dump during active cooling, when there is nowhere to make use of the excessive energy, the **Circulation pump (heat dump)** (39) starts and the **Reversing valve heat dump*** (76) switch from heating to heat dump to bore hole or an additional cooling battery. When a cooling battery is activated it will adjust to keep the set value for the **Return line sensor heat dump** (61). The receiving unit (cooling battery) must be able to handle a 0-10V signal to function. The signal will increase if the temperature for **Return line sensor heat dump** (61) increases and vice versa.
* It is also possible to use **Shunt valve heat dump** (251). Then the excessive heat can be distributed between bore hole/chiller and the heating system simultaneously when there is a heat demand.

Commission after installation:

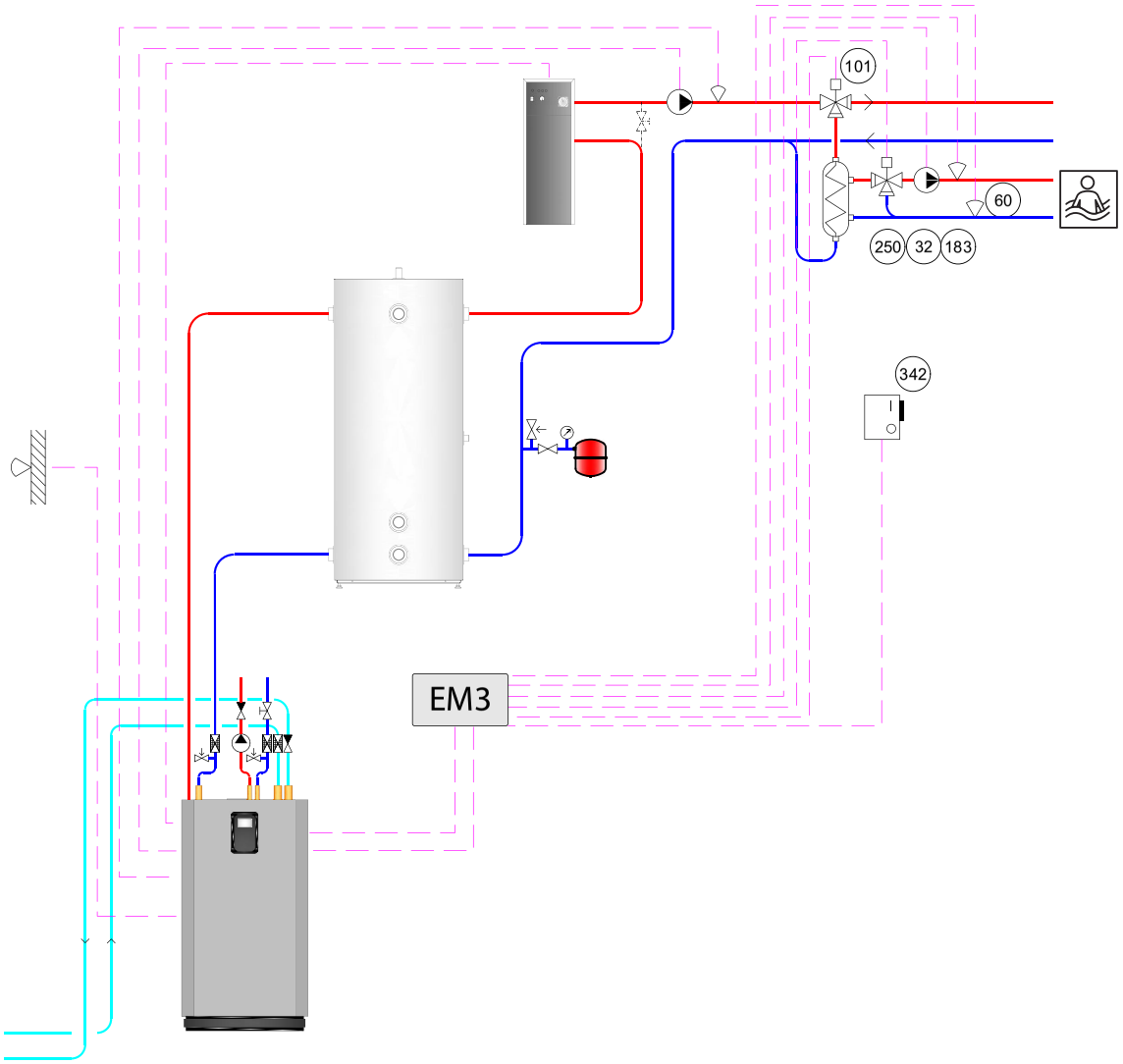
1. Login: Press padlock, 607080 and confirm
2. Go to SETTINGS/INSTALLATION and activate COOLING
3. Go to SETTINGS/COOLING and turn on function
4. Make desired settings and save
5. Restart the heat pump and check functionality

4.1.5 Function ID: 5, Pool

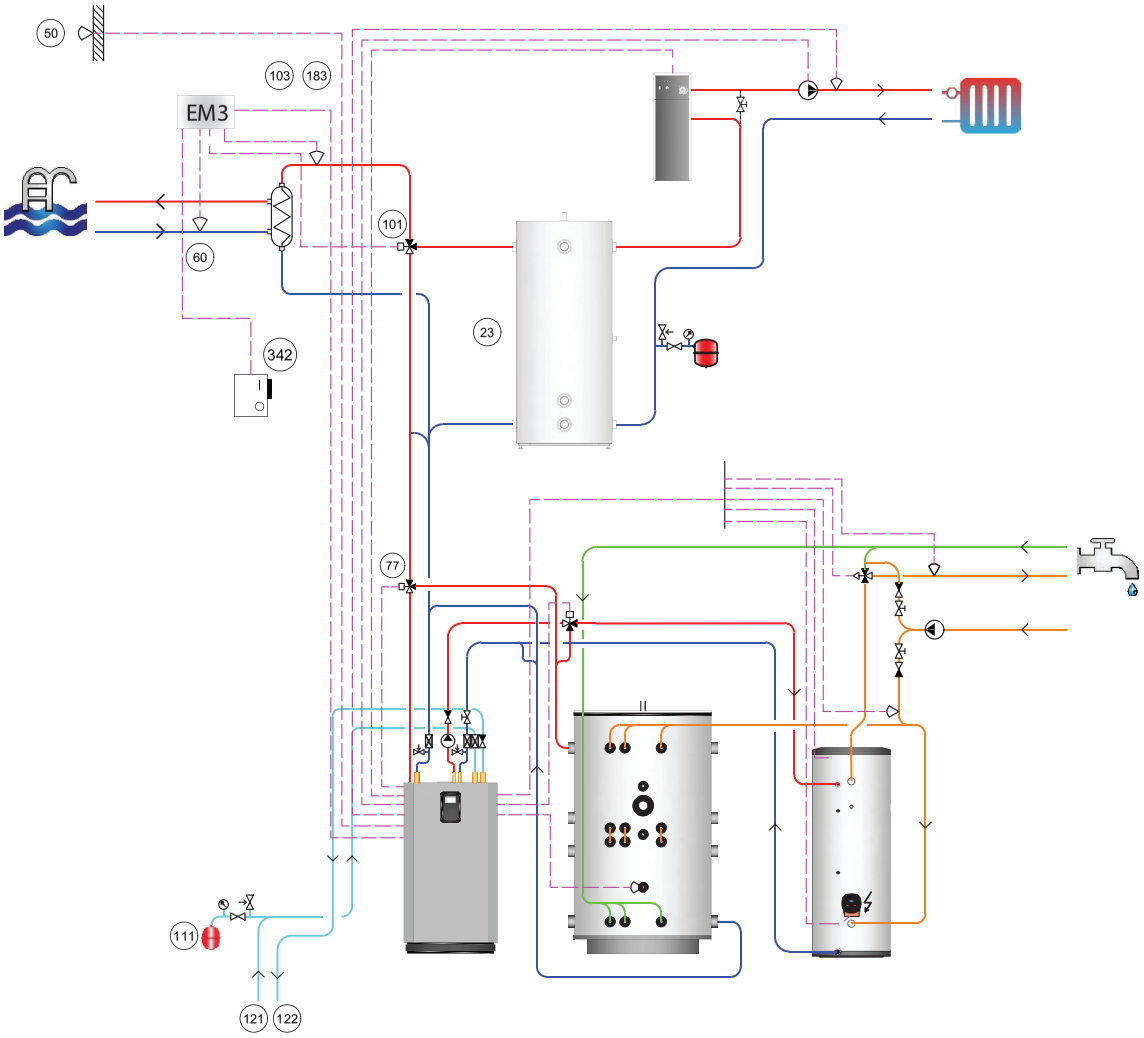
Pool solution 1



Pool solution 2



Pool solution 3



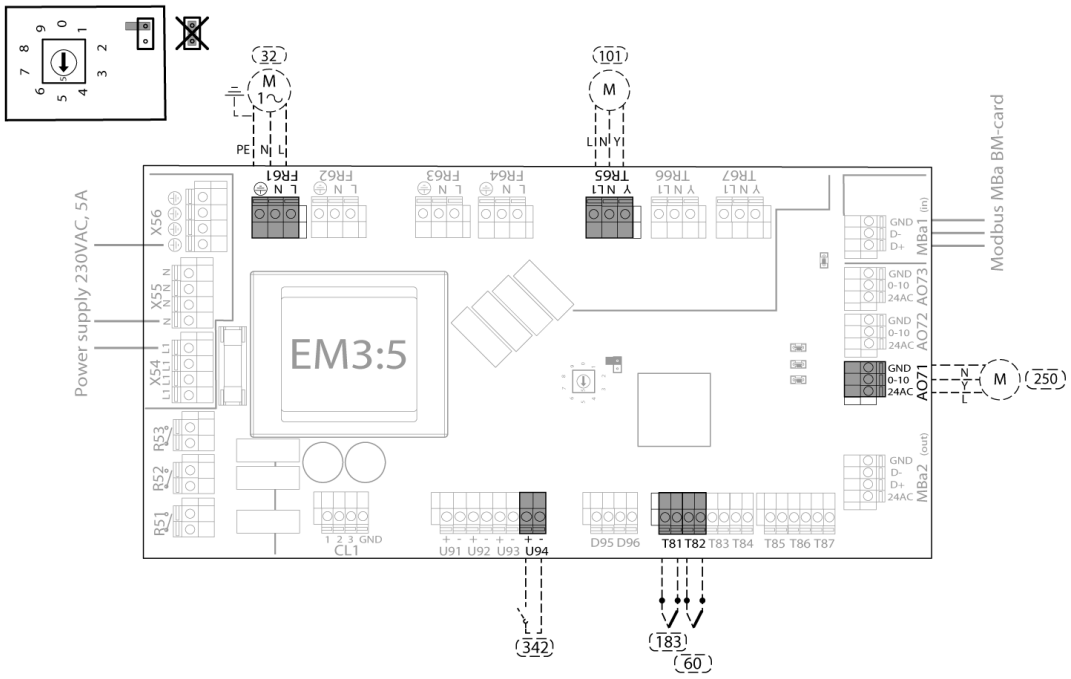


Table item number	Terminal	Description
32	FR61	Circulation pump (pool)
60	T82	Sensor pool
101	TR65	Reversing valve pool
183	T81	Supply line sensor pool
250	AO71	Shunt pool circuit
342	U94	External pool off

The purpose of this function is to control and maintain a constant temperature for swimming pool or similar.

The heat pump will determine the need for pool heating by the **Sensor pool** (60). When the pool heating starts, the **Reversing valve pool** (101) will direct the flow towards the pool heat exchanger and the heat pump will then produce pool heating. Pool heating will stop when the temperature read value has increased with the pool hysteresis value (or when the pool time is exceeded).

Required connections:

- 230V reversing valve
- PT-1000 temp sensor pool return temp is used for pool control
- Pool equipment (e.g. heat exchanger, pumps etc.)

Optional accessories:

- T1000 temp sensor for pool supply (183). Not used for control, only a read value in the display
- Optional external "pool off" function (342), controlled via digital input from e.g. circuit breaker (normally open)

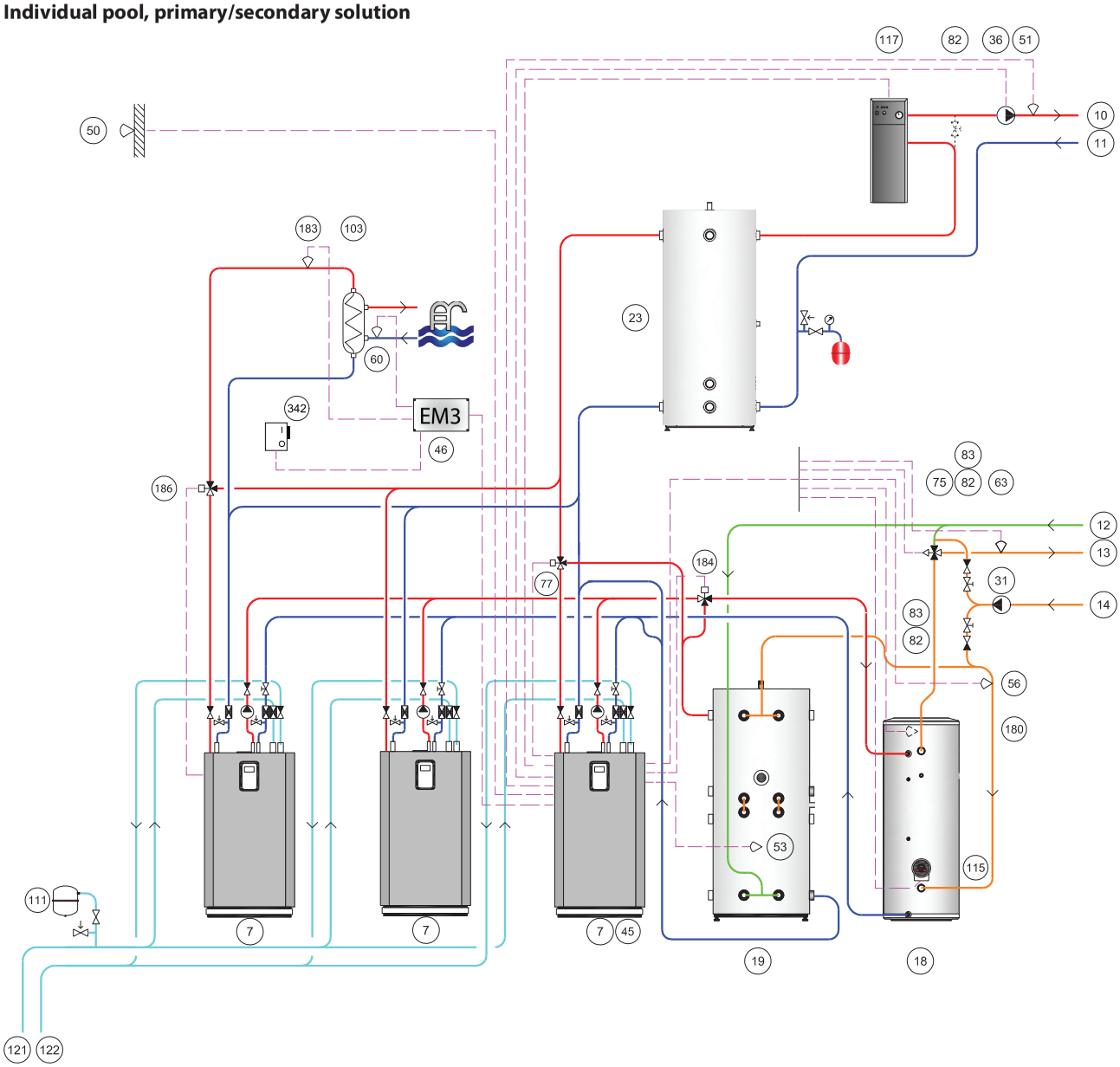
Settings description:
Desired pool return temperature: Target (median) temperature from pool return sensor.
Pool hysteresis: Total permitted deviation for start/stop heating (offset from desired pool temperature.)
Desired charge temp: Target temperature for heat pump supply line. (Calculation/selection of compressor speed is based on heat pump supply line temperature.)
Compressor max/min gear: Compressor speed range permitted for pool, may be used to optimize performance.

Pool time: Max pool time when other conflicting demands arises (such as heating/hot water demands), in heating season max 3,5 hours.
Gear shift delay: Delay time for changing compressor speed.

Commission after installation:

1. Login: Press padlock, 607080 and confirm
2. Go to SETTINGS/INSTALLATION and activate Pool
3. Go to SETTINGS/POOL and turn on function
4. Make desired settings and save
5. Restart the heat pump and check functionality

Individual pool, primary/secondary solution



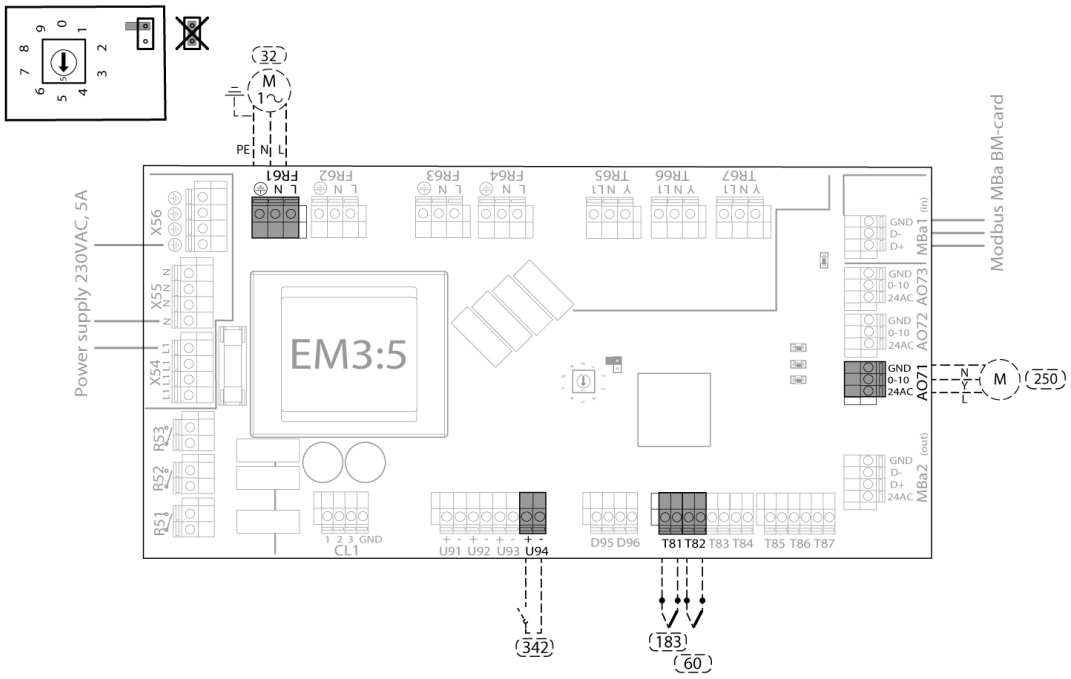


Table item number	Terminal	Description
32	FR61	Circulation pump (pool)
60	T82	Sensor pool
183	T81	Supply line sensor pool
186	TR9 (Connect to internal BM card on heat pump)	Reversing valve individual pool
250	AO71	Shunt pool circuit
342	U94	External pool off

This function supports the control of pool heating in a primary/secondary system using dedicated heat pumps. The heat pump(s) to support this must have the reversing valve for individual pool installed, **Reversing valve individual pool** (186). This valve should **NOT** be connected to the EM3 card, but instead to the internal BM card to terminal **TR9**, in order for the heat pump(s) to produce pool heating individually (the primary heat pump, as well as one or more secondary heat pumps, can be set up to control the individual pool heating as long as they meet these criteria). Below are instructions to set up the primary/secondary heat pump(s) so that they can communicate as intended. A primary/secondary connection needs to be setup before setting up the individual pool functionality.

Setting up the primary heat pump:

1. Login: Press padlock, 607080 and confirm
2. Go to SETTINGS/INSTALLATION and activate Pool
3. Go to SETTINGS/POOL and press **Enable Pool** and ***Enable pool on primary**
4. Make desired settings and save
5. Restart the heat pump and check functionality

*(If the primary heat pump is dedicated to make pool heating in a primary/secondary system, this switch needs to be activated)

Setting up a secondary heat pump:

1. Go to SETTINGS/INSTALLATION and activate Pool
2. Go to SETTINGS/POOL and press **Enable Pool**
3. Make desired settings and save
4. Restart the heat pump and check functionality

4.1.6 Function ID: 10-17, Legacy

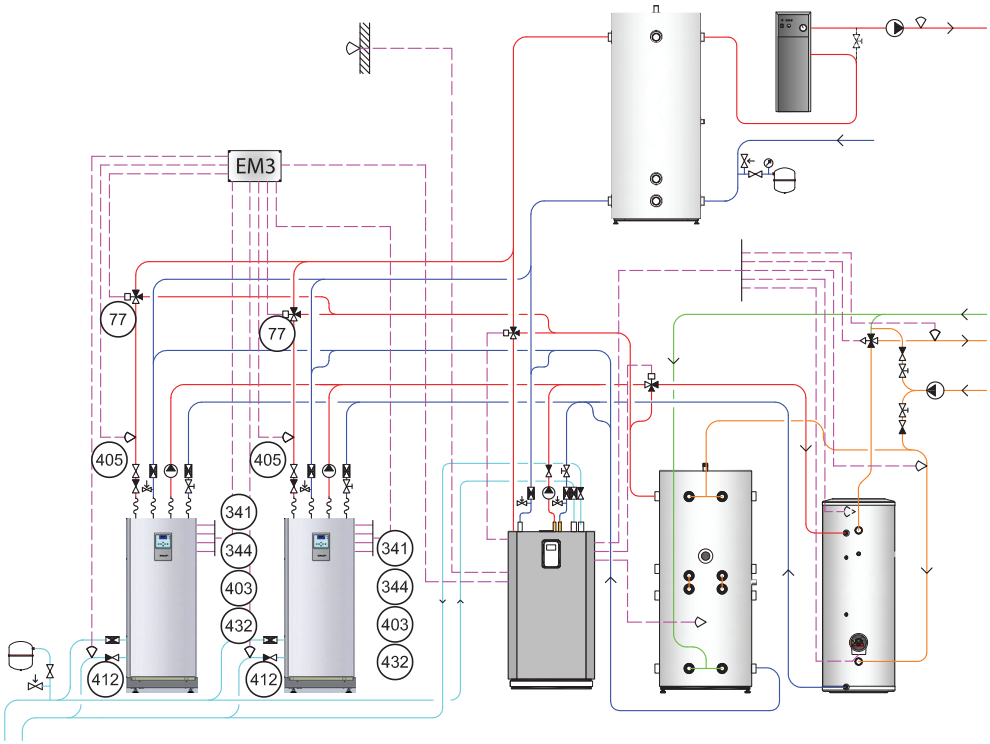
Example on how to structure Primary/Secondary installations:

Legacy 1 (1)
Legacy 2 (2)

Legacy 3 (1)
Legacy 4 (2)

Legacy 5 (1)
Legacy 6 (2)

Legacy (example)



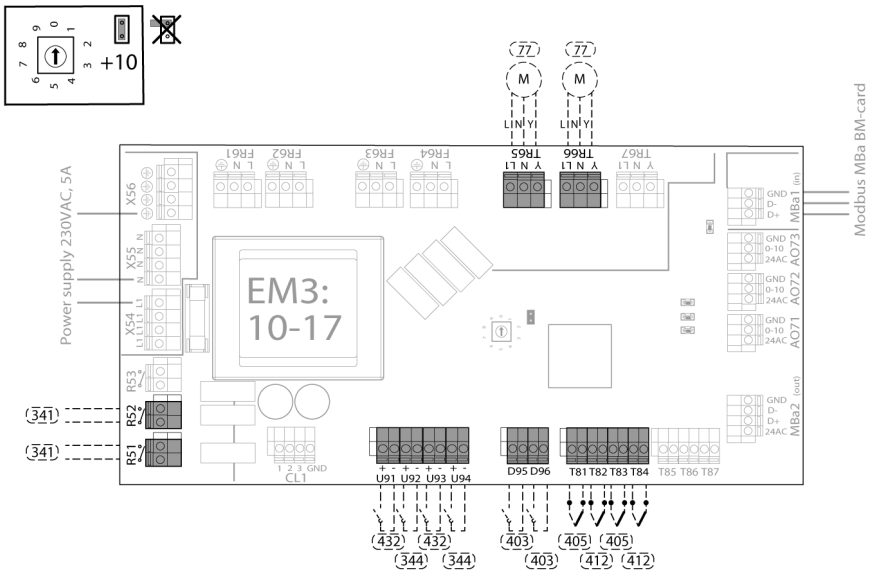
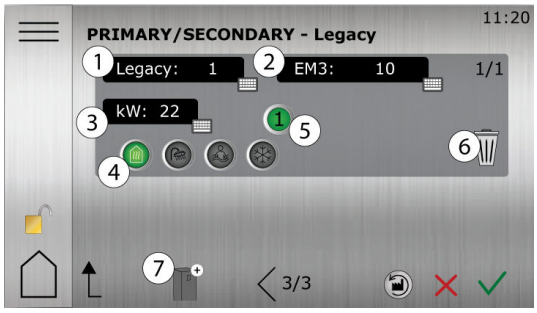
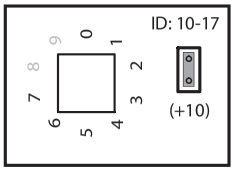


Table item number	Terminal	Description
77	TR65	Reversing valve hot water (Legacy 1)
77	TR66	Reversing valve hot water (Legacy 2)
341	R51	Start signal (Legacy 1)
341	R52	Start signal (Legacy 2)
344	U92	Alarm relay (Legacy 1)
344	U94	Alarm relay (Legacy 2)
403	D95	Operating pressure switch (Legacy 1)
403	D96	Operating pressure switch (Legacy 2)
405	T81	Radiator out sensor (Legacy 1)
405	T83	Radiator out sensor (Legacy 2)
412	T82	Brine out sensor (Legacy 1)
412	T84	Brine out sensor (Legacy 2)
432	U91	Signal compressor in operation (Legacy 1)
432	U93	Signal compressor in operation (Legacy 2)



1. Legacy: Set unique number of the legacy heat pump (1-16).
2. EM3: Set the correlating ID for the EM3. Adjusted with the ID-selector on the PCB.
3. kW: Set the estimated output of the legacy heat pump. For own reference only, does not affect anything.
4. Choose which functions to support.
5. Choose between 1 or 2. Each EM3-card supports up to two legacy heat pumps.
6. Discard installation.
7. Add legacy heat pump.



Function description, Legacy control (heat pumps <u>not</u> using Genesis control)

WIth Legacy functionality it is possible to control one or more external heat pumps, that don't have a Genesis control system, with a Mega heat pump as a Primary unit.
Whenever there is a demand to start the legacy heat pump this is done with a **Start signal (Legacy)** (341). When the demand is no longer active, the signal stops.
If there is a **Signal compressor in operation** (432) installed, this is connected to terminal U91 (or U93 for a second legacy heat pump) and is monitored by the main heat pump.
Alarm relay (344), if installed, is connected to U92 (or U94 for a second legacy heat pump) and is monitored by the main heat pump.
Brine out sensor (Legacy 1 and 2) (412) and **Radiator out sensor (Legacy 1 and 2)** (405) are only for reading values. They show the outgoing temperatures for condensor and collector.

Commission after installation:

1. Login: Press padlock, 607080 and confirm
2. Go to SETTINGS/INSTALLATION and activate Primary/Secondary
3. Go to SETTINGS/"Primary/Secondary" and turn on function

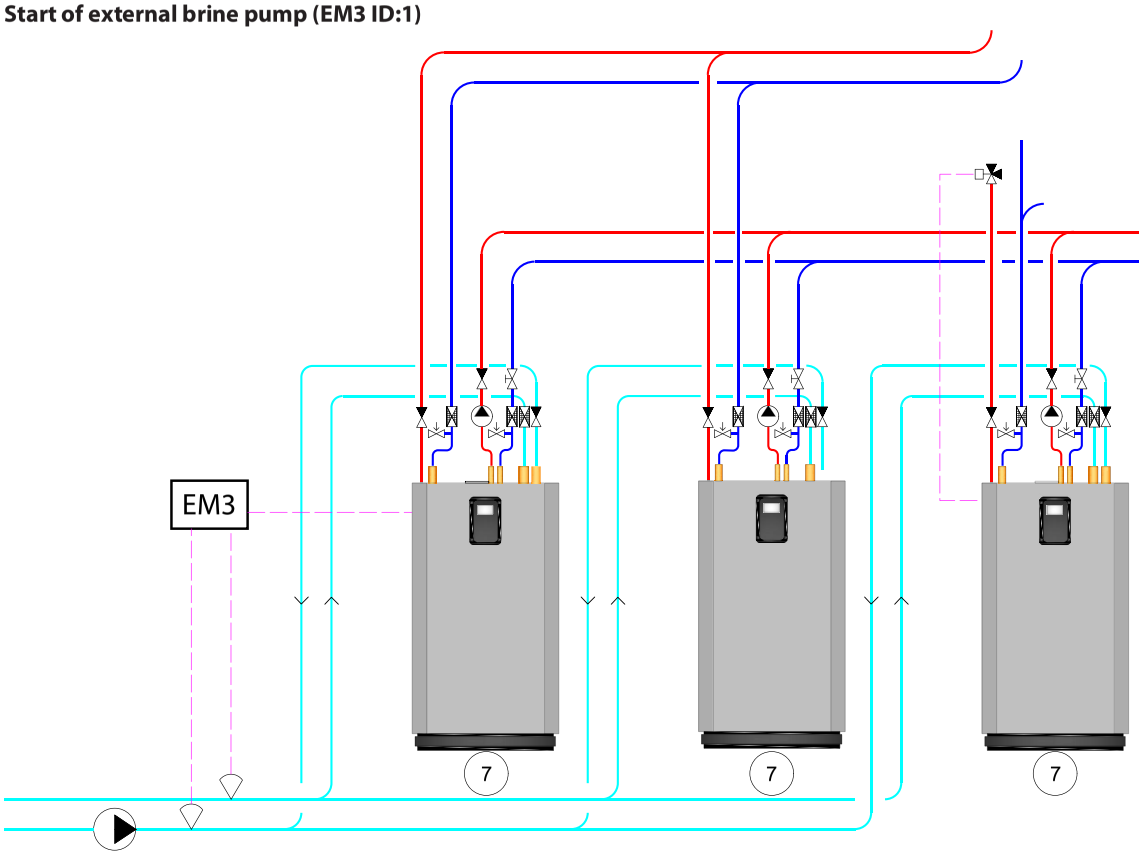
4. Make desired settings and save
5. Restart the heat pump and check functionality

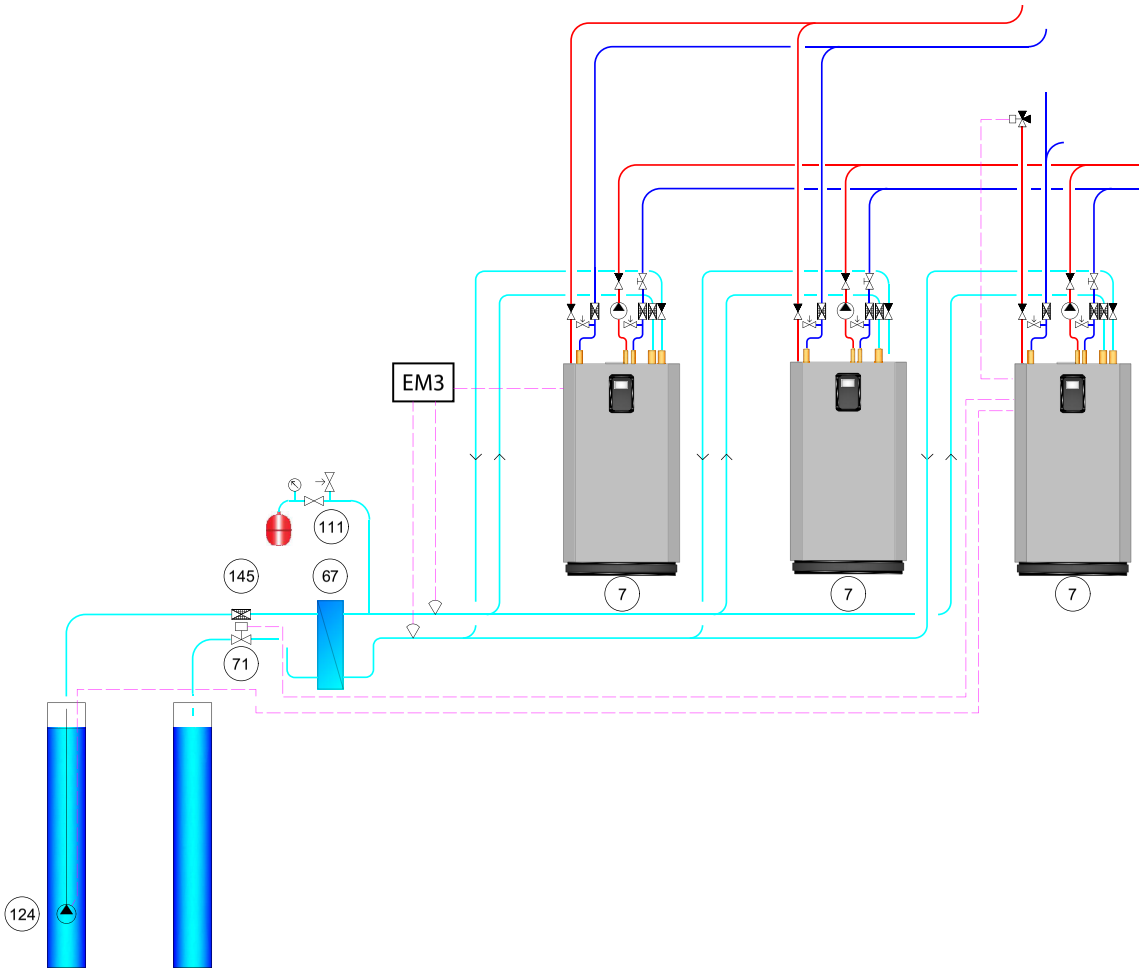
4.1.7 Control of internal brine pump on external signal

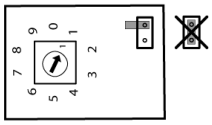
Internal brine pump on external signal (ID:1-5)
In applications where e.g. cooling is achieved by a separate system (not controlled by the heat pump), the internal brine pump can be activated (345) on external command using EM3:1-5, not available with EM3:10-16 (Legacy). The digital in (open/closed loop) will then activate the internal brine pump when required. The internal brine pump will run when the control signal loop is closed.

4.1.8 Start of external brine pump 0-10V

Start of external brine pump (EM3 ID:1)




EM3
111
145
67
71
7
7
7
124



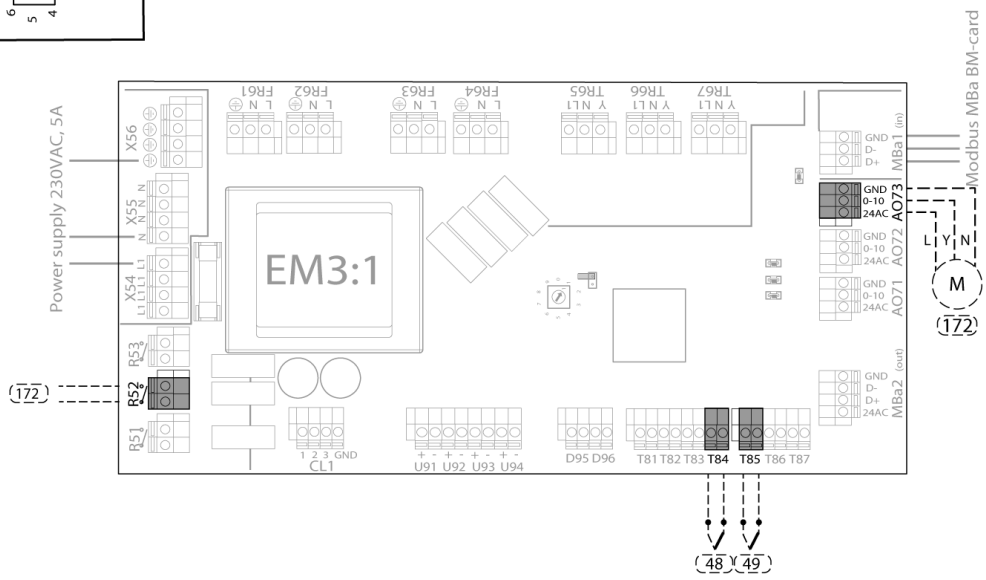

Power supply 230VAC, 5A
X56
X55
X54
EM3:1
R53
R52
R51
172
CL1
U91 U92 U93 U94
D95 D96
T81 T82 T83 T84 T85 T86 T87
MBa1 (in)
AO73
AO72
AO71
MBa2 (out)
Modbus MBa BM-card
M
48
49

Table item number	Terminal	Description
48	T84	Sensor external brine in
49	T85	Sensor external brine out
172	AO73	Auxiliary circulation pump (brine)
172	R52	Auxiliary circulation pump (brine)

0-10V control of external brine pump/groundwater pump (EM3 ID:1).

Requires two sensors connected to brine in (48) and brine out (49). Output (0-10V) is connected to AO73 (172). If an on/off signal is required, use relay R52 on EM3 for potential free signal or FR4 on BM for 230V signal.

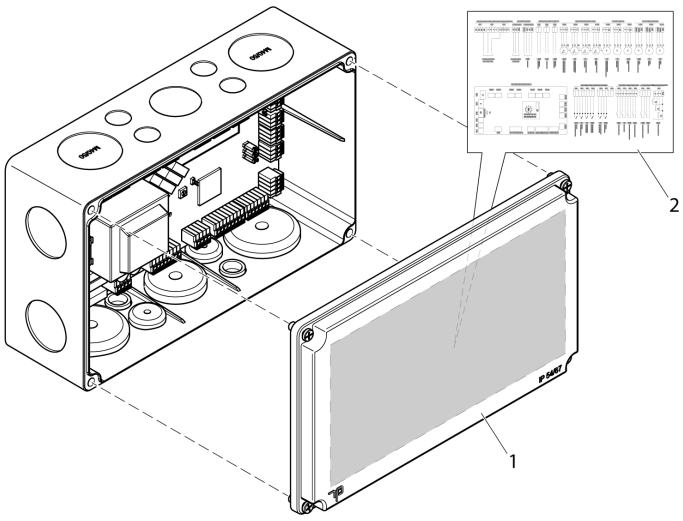
- When the external brine pump is active, the pump regulates the external brine delta according to the desired delta setting. The delta refers to the external brine in and out temperature. In the case of a flow guard error, the external brine pump will stop.
- **Intermediate exchanger (On)** - The external brine pump starts when the internal brine pump is running or, in the case of a primary/secondary configuration, when another heat pump starts.
- **Intermediate exchanger (Off)** - The external brine pump starts if the external brine delta is 1K above the desired delta. The external brine pump stops if the external brine delta is 1K below the desired delta and the external brine pump speed is at minimum.
- **Kp** - The proportional part in the pump speed regulation. Higher Kp makes the pump change speed more aggressively.

4.2 Finishing steps

1. When all wire connection is finished, make a final inspection to ensure that:

- there are no loose ends
- that all connections are fastened securely in the terminals
- the wires aren't routed or bundled too tightly and thereby putting stress on the terminals
- all sealing plugs fits correctly and securely in place on the enclosure.

2. Put the wiring decal on the **inside** of the enclosure cover, and the ID decal on the front, for a quick overview of what function is configured with the EM3.



(1) Enclosure cover

(2) Wiring decal

3. Fit the cover on the enclosure and tighten the screws.

5 Table item number

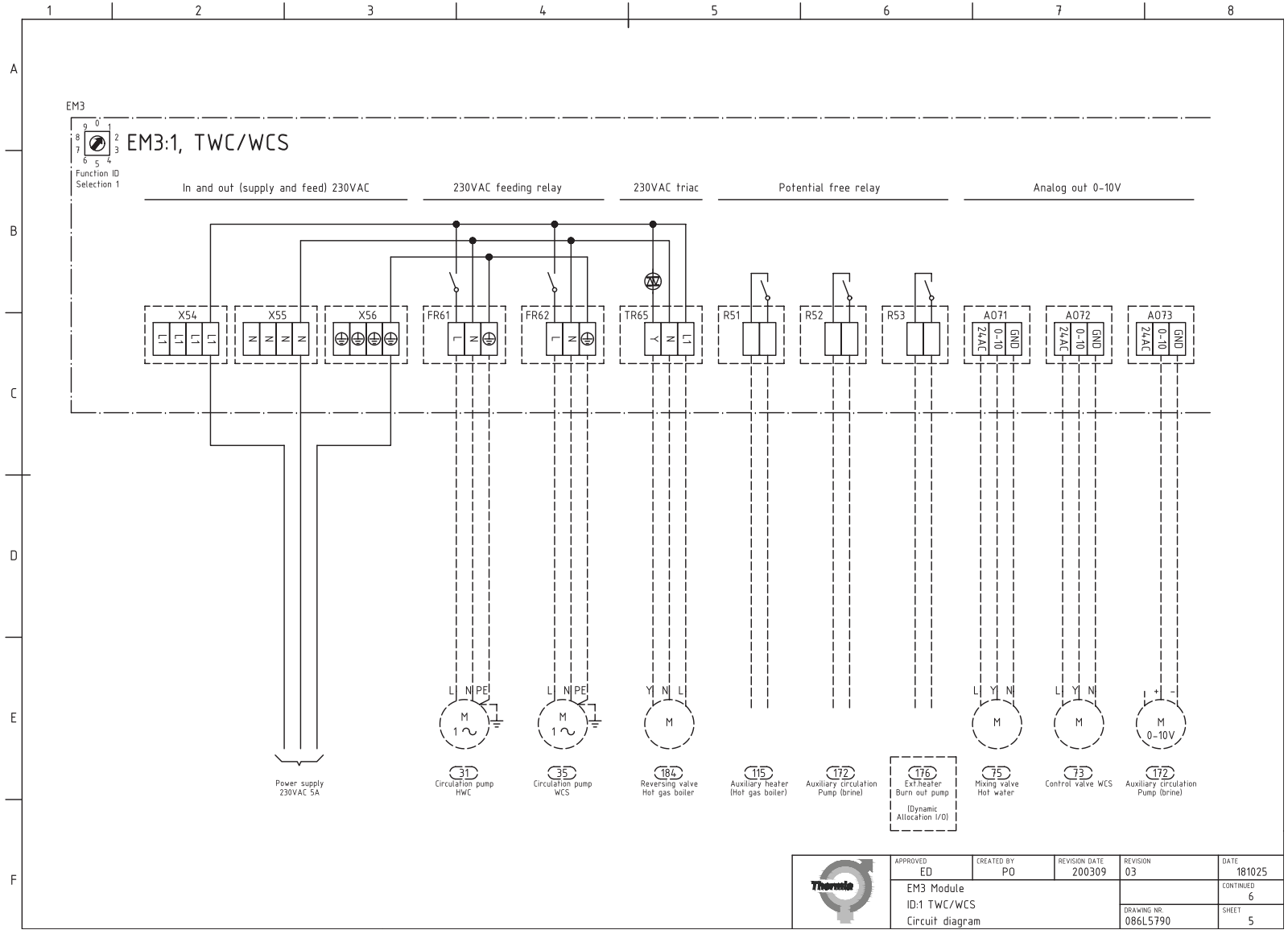
The following number/note are used for the heat pump. Which number/note are used depends on the heat pump model.

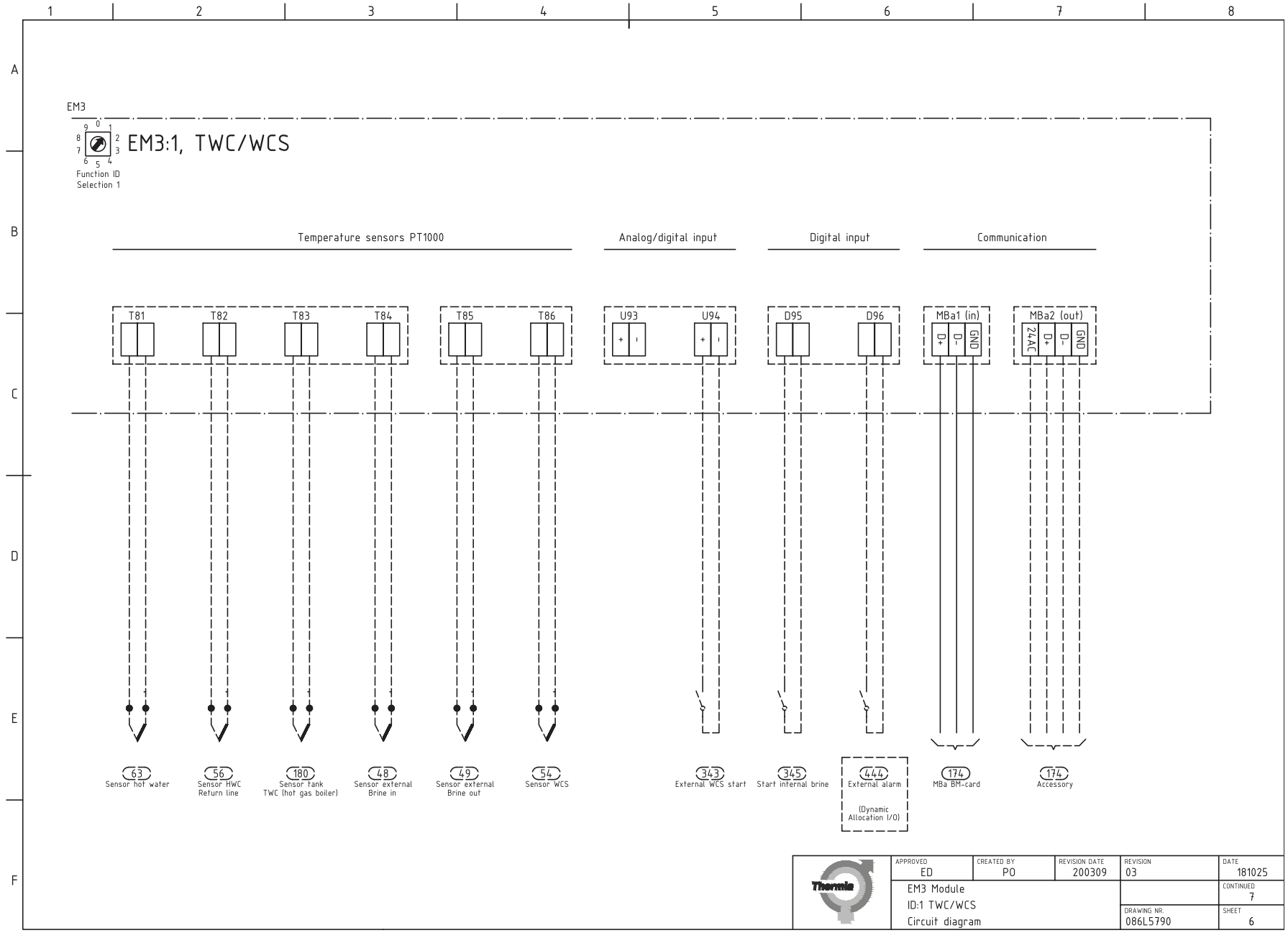
Number/Note	Description
31	Circulation pump (HWC)
32	Circulation pump (pool)
33	Circulation pump (shunt auxiliary heater)
34	Circulation pump (hot gas)
35	Circulation pump (WCS)
36	Circulation pump (system)
38	Circulation pump (cooling circuit)
39	Circulation pump (heat dump)
40	Expansion card
48	External brine in sensor
49	External brine out sensor
50	Outdoor sensor
51	System supply line sensor
52	System return line sensor
53	Hot water sensor lower
54	Sensor (WCS)
55	Hot water sensor top
56	Sensor HWC return line
57	Return line sensor cooling tank
58	Supply line sensor cooling circuit
59	Sensor cooling tank
60	Sensor pool
61	Return line sensor heat dump
62	Room sensor
63	Sensor hot water
64	Sensor cold water
71	Flow guard
72	External auxiliary heater shunt
73	Control valve WCS
74	Shunt valve cooling circuit
75	Mixing valve HW
76	Reversing valve heat dump
77	Reversing valve hot water
78	Reversing valve cooling
79	Reversing valve active cooling
101	Reversing valve pool
107	Shunt (distribution circuit 1)
108	Supply line sensor (distribution circuit 1)
109	Circulation pump (distribution circuit 1)
115	Auxiliary heater hot gas boiler
117	External auxiliary heater
118	Auxiliary heater (anti-legionella)
119	Control signal dry cooler
132	Passive room sensor

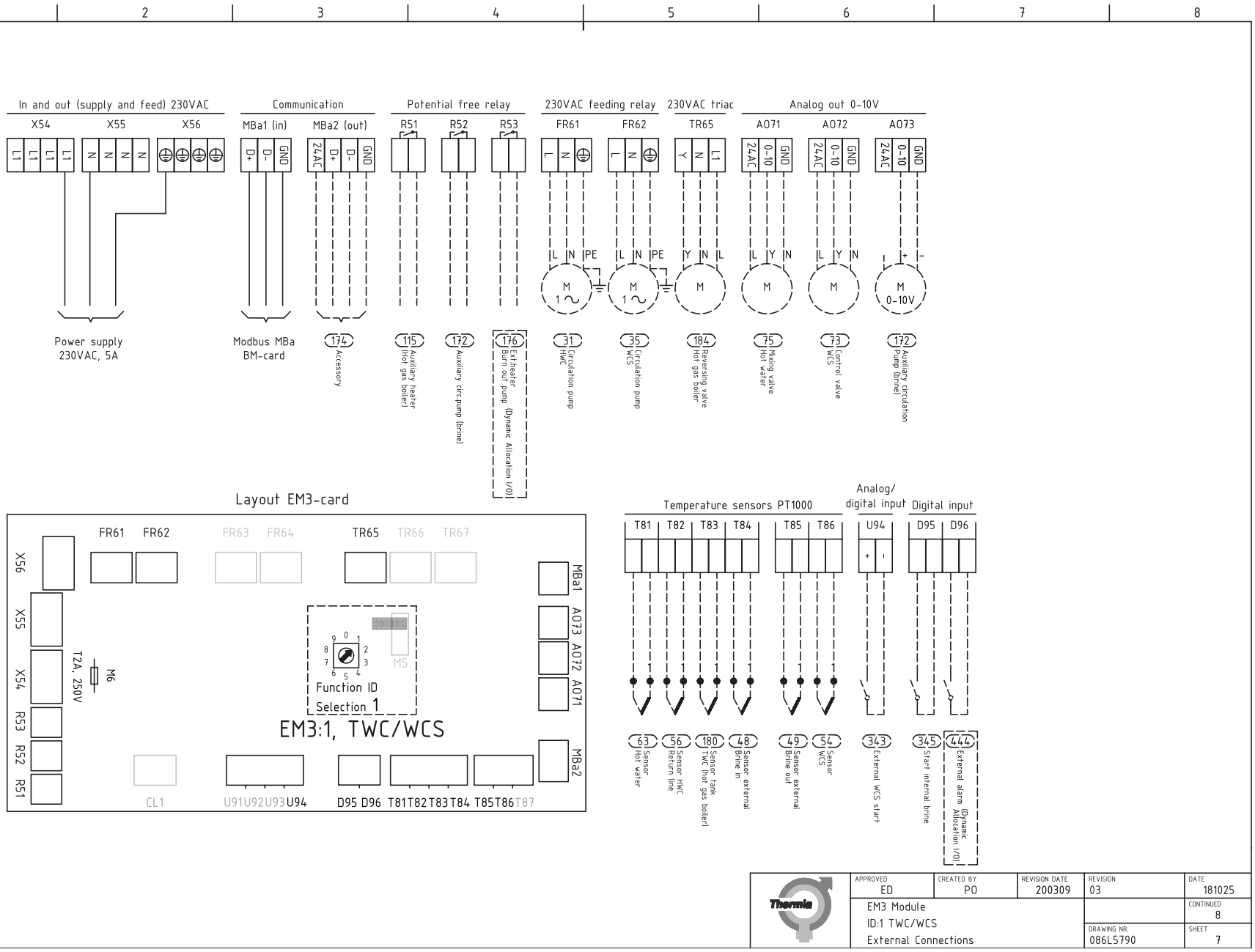
Number/Note	Description
136	Buffer tank sensor
143	Return line shunt
170	System circ. pump A
171	System circ. pump B
172	Auxiliary circ. pump (brine)
173	BMS/Building management system
174	Accessory
175	Accessory monitoring online
176	External heater burn out pump
180	Tank sensor TWC (hot gas boiler)
181	Return line sensor (cooling circuit)
182	Supply line sensor heat dump
183	Supply line sensor pool
184	Reversing valve hot gas boiler
185	Reversing valve cooling mode
186	Reversing valve individual pool
207	Shunt (distribution circuit 2-5)
208	Supply line sensor (distribution circuit 2-5)
209	Circulation pump (distribution circuit 2-5)
210	Return line sensor (distribution circuit 2-5)
250	Shunt pool circuit
251	Shunt valve heat dump
301	Compressor
302	Brine pump
304	Spare circulation pump
308	Condenser pump
310	Reversing valve
312	Bypass valve
313	Electronic expansion valve
317	Immersion heater
318	Circulation pump secondary unit
319	Solenoid valve
340	Temperature guard
341	Start signal
342	External pool off
343	External WCS start
344	Alarm relay
345	Start signal internal brine
346	Start signal cooling
347	Cooling mode
364	Shunt valve hot water
365	Supply line sensor secondary
366	Return line sensor secondary
370	Secondary circuit pump

Number/Note	Description
375	Brine valve
377	Reversing valve volume tank
403	Operating pressure switch
405	Radiator out sensor
407	HGW sensor
408	EVU/Smart grid 1
409	Smart grid 2
411	Radiator return sensor
412	Brine out sensor
413	Brine in sensor
414	High pressure switch
416	Discharge pipe sensor
421	Suction gas sensor
422	Dewpoint sensor
431	Liquid line sensor
432	Signal compressor in operation
433	Low pressure transmitter
434	High pressure transmitter
435	Inverter
436	DI 1
437	DI 2
438	DI 3
439	DI 4
440	Spare
441	Communication card
442	Main PCB
443	Sub PCB
444	External alarm

Number/Note	Description
445	DI 5
446	DI 6
447	DI 7
448	DI 8
449	DC-choke
453	Display
455	Indoor hub controller
456	Current Limiter
* Note 8	Alarm
* Note 9	Speed control
* Note 15	Immersion heater or external auxiliary heater
* Note 16	Potential free contact
* Note 17	To outdoor unit
* Note 18	To expansion unit
* Note 19	Communication
* Note 28	230VAC for external loads
* Note 29	Max 5A load
* Note 30	24VAC for external loads
* Note 31	Max 1A load in total
*Note 32	The outdoor unit is equipped with a modbus communication card, which is not shown in this circuit diagram. Terminal F1/F2 is connected to the communication card, instead of to main PCB. Fore more information about communication card connections, see following page.
*Note 33	15kW immersion heater is optional
*Note 34	Works only together with EM3-card


EM3
EM3:1, TWC/WCS
Function ID
Selection 1
In and out (supply and feed) 230VAC
230VAC feeding relay
230VAC triac
Potential free relay
Analog out 0-10V
X54
X55
X56
FR61
FR62
TR65
R51
R52
R53
AO71
AO72
AO73
Power supply
230VAC 5A
31
Circulation pump
HWC
35
Circulation pump
WCS
184
Reversing valve
Hot gas boiler
115
Auxiliary heater
(Hot gas boiler)
172
Auxiliary circulation
Pump (brine)
176
Ext.heater
Burn out pump
(Dynamic
Allocation I/O)
75
Mixing valve
Hot water
73
Control valve WCS
172
Auxiliary circulation
Pump (brine)
EM3 Module
ID:1 TWC/WCS
Circuit diagram
APPROVED ED
CREATED BY PO
REVISION DATE 200309
REVISION 03
DATE 181025
CONTINUED 6
DRAWING NR. 086L5790
SHEET 5


EM3
EM3:1, TWC/WCS
Function ID
Selection 1
Temperature sensors PT1000
Analog/digital input
Digital input
Communication
T81
T82
T83
T84
T85
T86
U93
U94
D95
D96
MBa1 (in)
D+
D-
GND
MBa2 (out)
24AC
D+
D-
GND
63
Sensor hot water
56
Sensor HWC
Return line
180
Sensor tank
TWC (hot gas boiler)
48
Sensor external
Brine in
49
Sensor external
Brine out
54
Sensor WCS
343
External WCS start
345
Start infernal brine
444
External alarm
(Dynamic
Allocation I/O)
174
MBa BM-card
174
Accessory
APPROVED
ED
CREATED BY
PO
REVISION DATE
200309
REVISION
03
DATE
181025
EM3 Module
ID:1 TWC/WCS
Circuit diagram
CONTINUED
7
DRAWING NR.
086L5790
SHEET
6

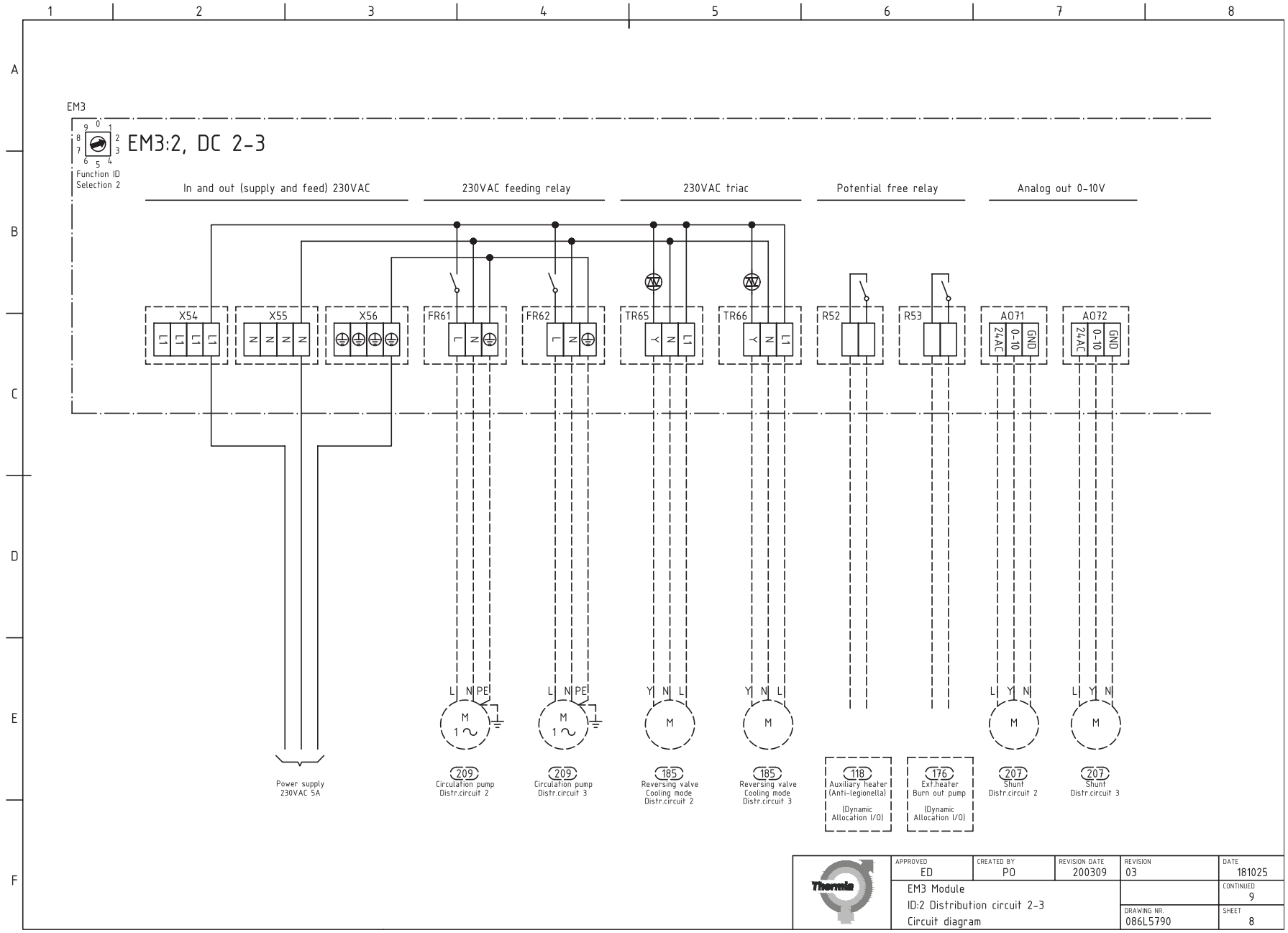


APPROVED	CREATED BY	REVISION DATE	REVISION	DATE
ED	PO	200309	03	181025

EM3 Module
ID:1 TWC/WCS
External Connections

CONTINUED	SHEET
8	7

DRAWING NR. 086L5790



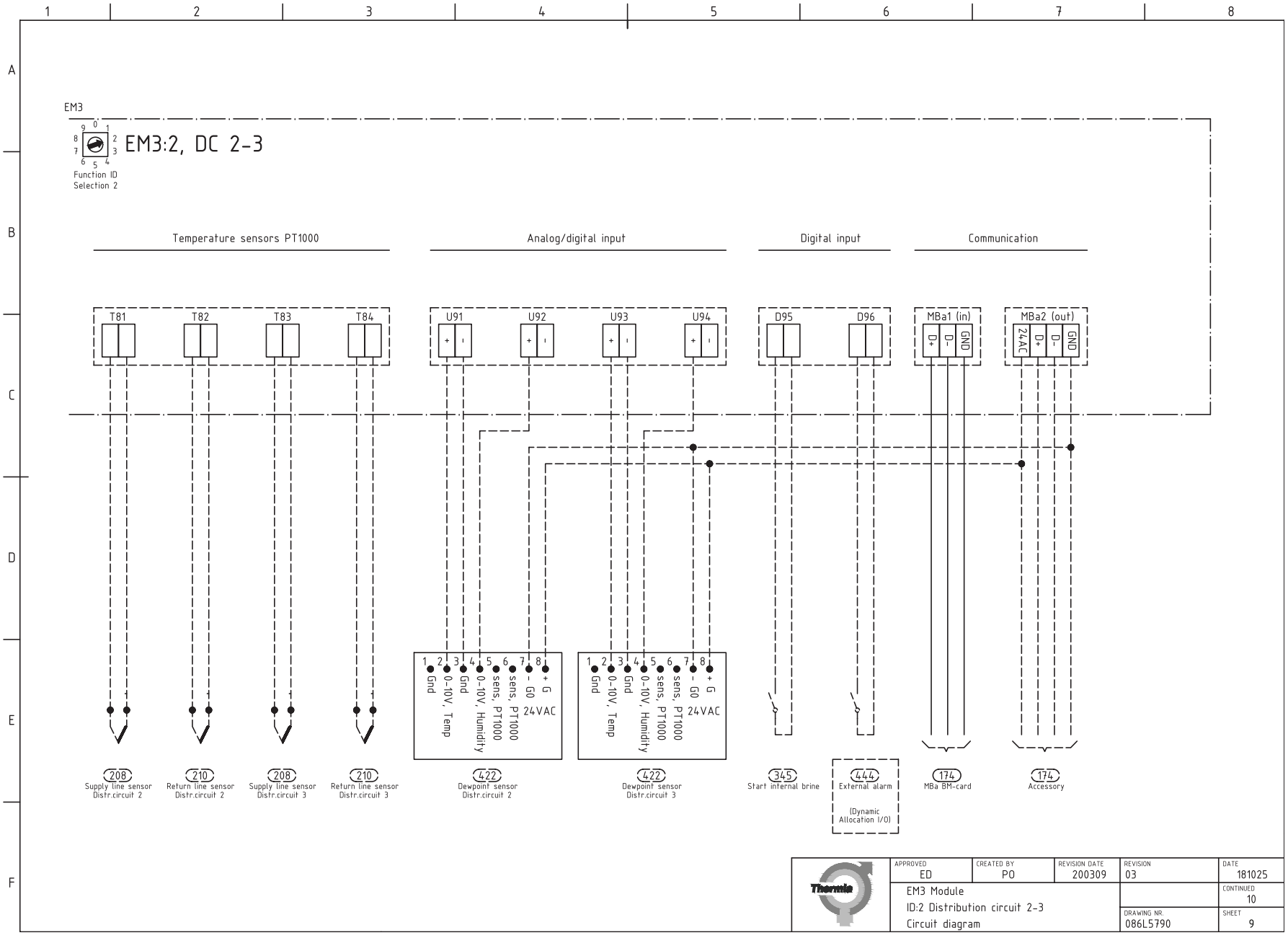
APPROVED	CREATED BY	REVISION DATE	REVISION	DATE
ED	PO	200309	03	181025

EM3 Module
ID:2 Distribution circuit 2-3
Circuit diagram

CONTINUED 9

DRAWING NR. 086L5790

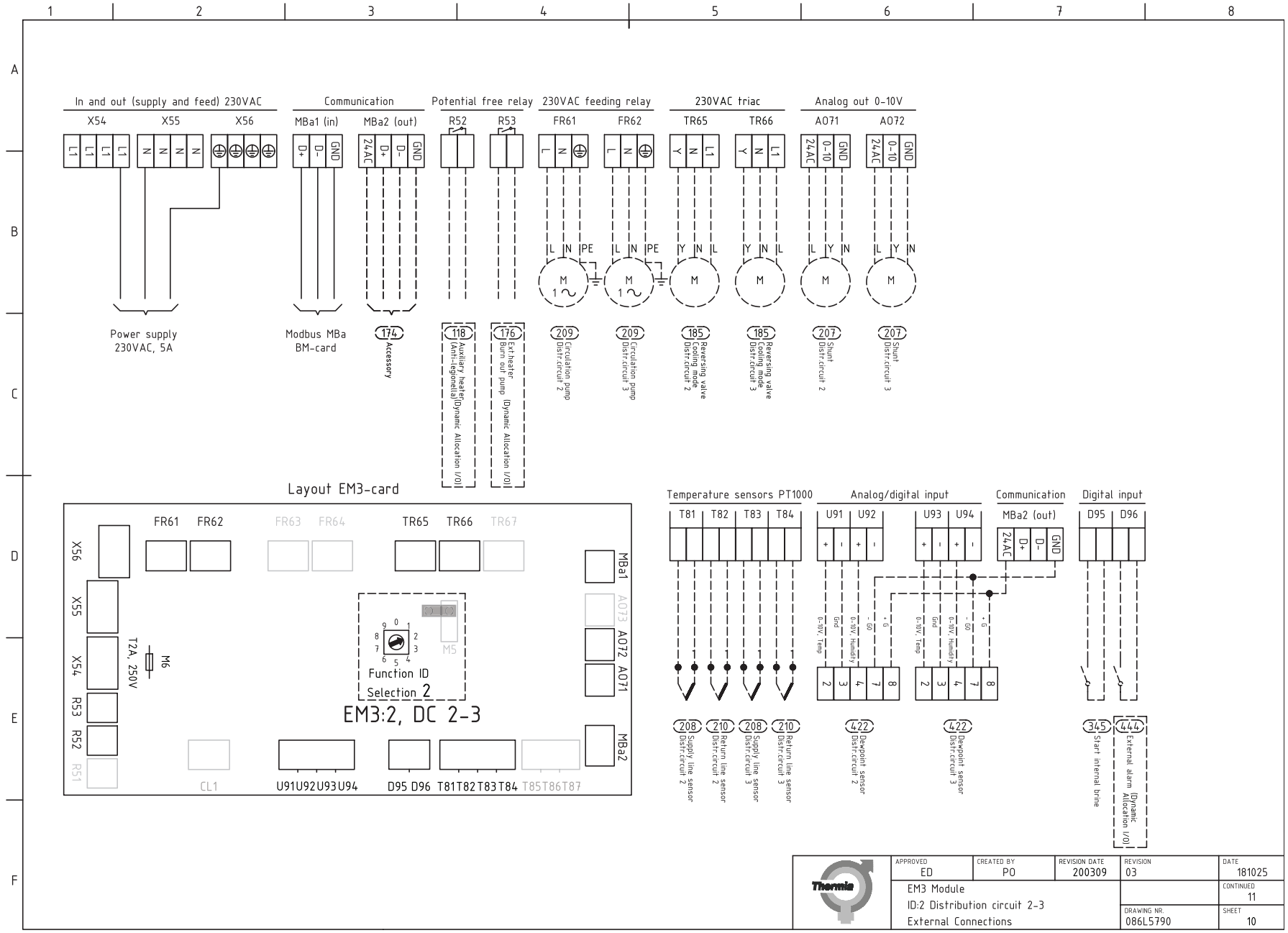
SHEET 8

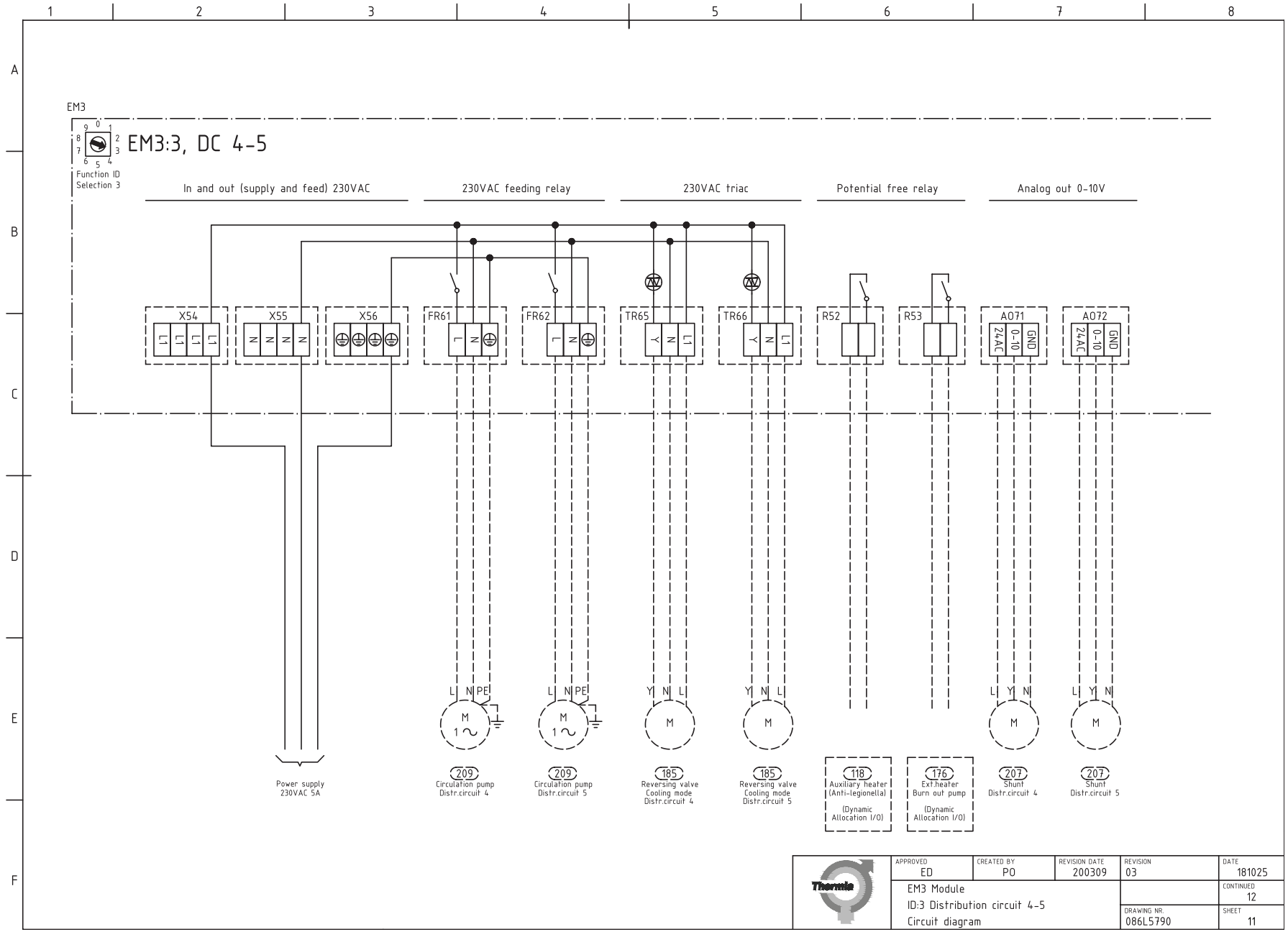


APPROVED	CREATED BY	REVISION DATE	REVISION	DATE
ED	PO	200309	03	181025

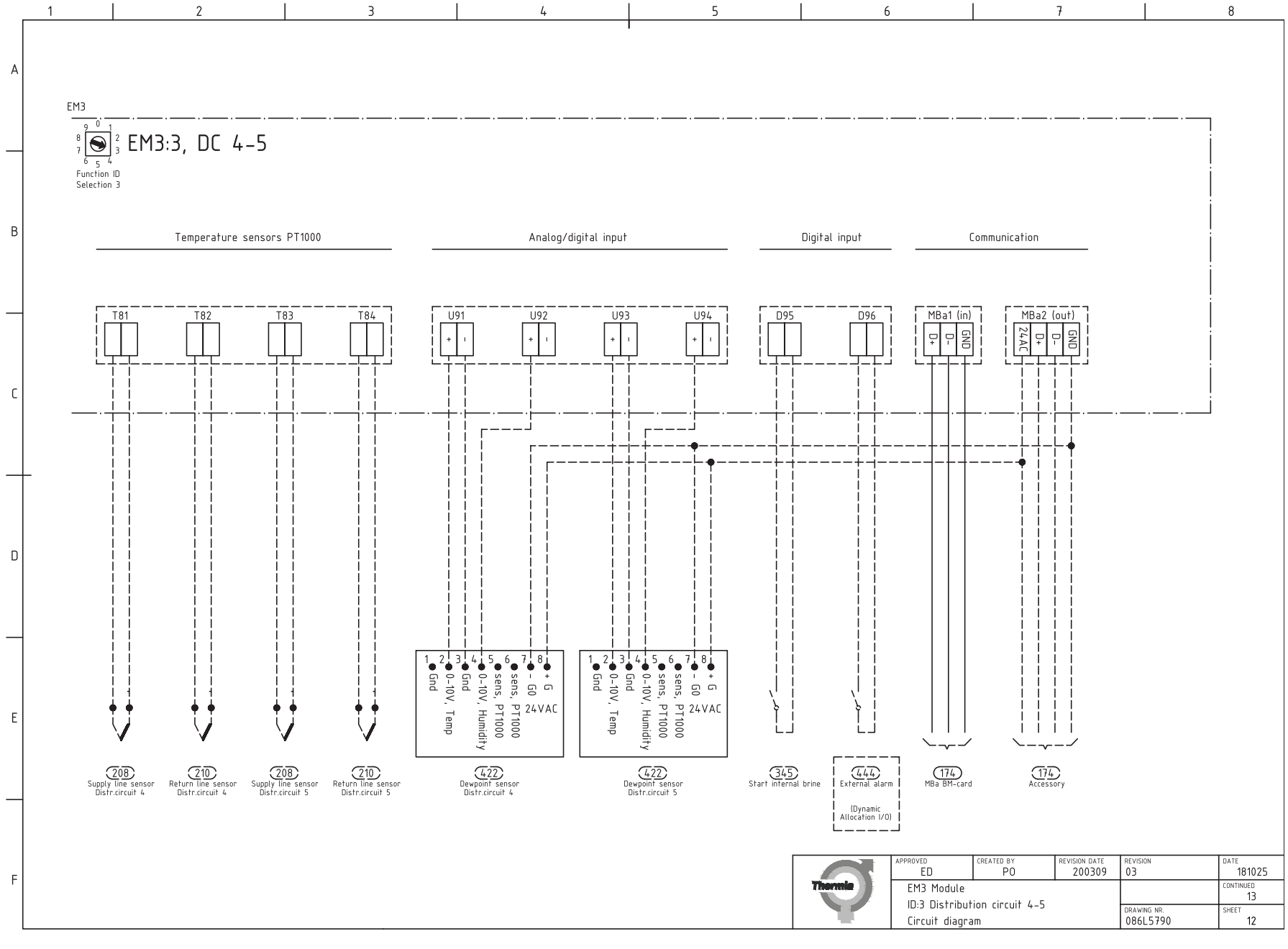
EM3 Module
ID:2 Distribution circuit 2-3
Circuit diagram

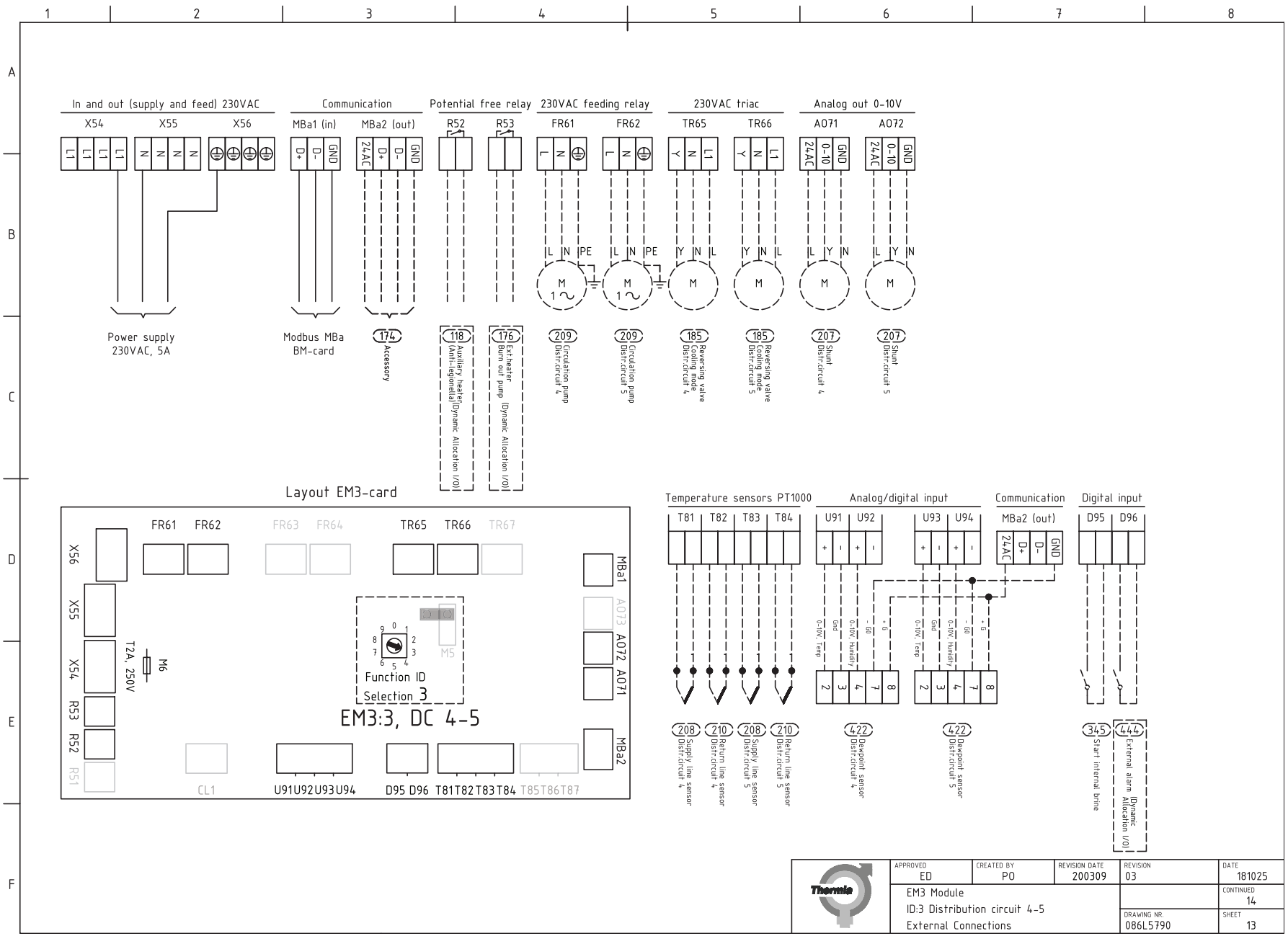
CONTINUED	DRAWING NR.	SHEET
10	086L5790	9


In and out (supply and feed) 230VAC
X54
X55
X56
Power supply
230VAC, 5A
Communication
MBa1 (in)
MBa2 (out)
Modbus MBa
BM-card
174
Accessory
Potential free relay
R52
R53
118
Auxiliary heater
(Anti-legionella)
(Dynamic Allocation I/O)
176
Ext.heater
Burn out pump
(Dynamic Allocation I/O)
230VAC feeding relay
FR61
FR62
209
Circulation pump
Distr.circuit 2
209
Circulation pump
Distr.circuit 3
230VAC triac
TR65
TR66
185
Reversing valve
Cooling mode
Distr.circuit 2
185
Reversing valve
Cooling mode
Distr.circuit 3
Analog out 0-10V
AO71
AO72
207
Shunt
Distr.circuit 2
207
Shunt
Distr.circuit 3
Layout EM3-card
FR61 FR62 FR63 FR64 TR65 TR66 TR67
X56
X55
X54
R53
R52
R51
T2A, 250V
M6
M5
Function ID
Selection 2
EM3:2, DC 2-3
MBa1
AO73
AO72
AO71
MBa2
CL1
U91U92U93U94
D95 D96
T81T82T83T84
T85T86T87
Temperature sensors PT1000
T81
T82
T83
T84
Analog/digital input
U91
U92
U93
U94
0-10V; Temp
Gnd
0-10V; Humidity
+ 0
- 60
Communication
MBa2 (out)
24AC
D+
D-
GND
Digital input
D95
D96
208
Supply line sensor
Distr.circuit 2
210
Return line sensor
Distr.circuit 2
208
Supply line sensor
Distr.circuit 3
210
Return line sensor
Distr.circuit 3
422
Dewpoint sensor
Distr.circuit 2
422
Dewpoint sensor
Distr.circuit 3
345
Start internal brine
444
External alarm
(Dynamic Allocation I/O)
APPROVED ED
CREATED BY PO
REVISION DATE 200309
REVISION 03
DATE 181025
EM3 Module
ID:2 Distribution circuit 2-3
External Connections
DRAWING NR. 086L5790
CONTINUED 11
SHEET 10



APPROVED	CREATED BY	REVISION DATE	REVISION	DATE
ED	PO	200309	03	181025
EM3 Module ID:3 Distribution circuit 4-5 Circuit diagram				CONTINUED 12
			DRAWING NR. 086L5790	SHEET 11


EM3
EM3:3, DC 4-5
Function ID
Selection 3
Temperature sensors PT1000
Analog/digital input
Digital input
Communication
T81
T82
T83
T84
U91
U92
U93
U94
D95
D96
MBa1 (in)
MBa2 (out)
D+
D-
GND
24AC
1 Gnd
2 0-10V, Temp
3 Gnd
4 0-10V, Humidity
5 sens, PT1000
6 sens, PT1000
7 - G0
8 + G
24VAC
208 Supply line sensor Distr.circuit 4
210 Return line sensor Distr.circuit 4
208 Supply line sensor Distr.circuit 5
210 Return line sensor Distr.circuit 5
422 Dewpoint sensor Distr.circuit 4
422 Dewpoint sensor Distr.circuit 5
345 Start infernal brine
444 External alarm
(Dynamic Allocation I/O)
174 MBa BM-card
174 Accessory
APPROVED ED
CREATED BY PO
REVISION DATE 200309
REVISION 03
DATE 181025
EM3 Module
ID:3 Distribution circuit 4-5
Circuit diagram
CONTINUED 13
DRAWING NR. 086L5790
SHEET 12



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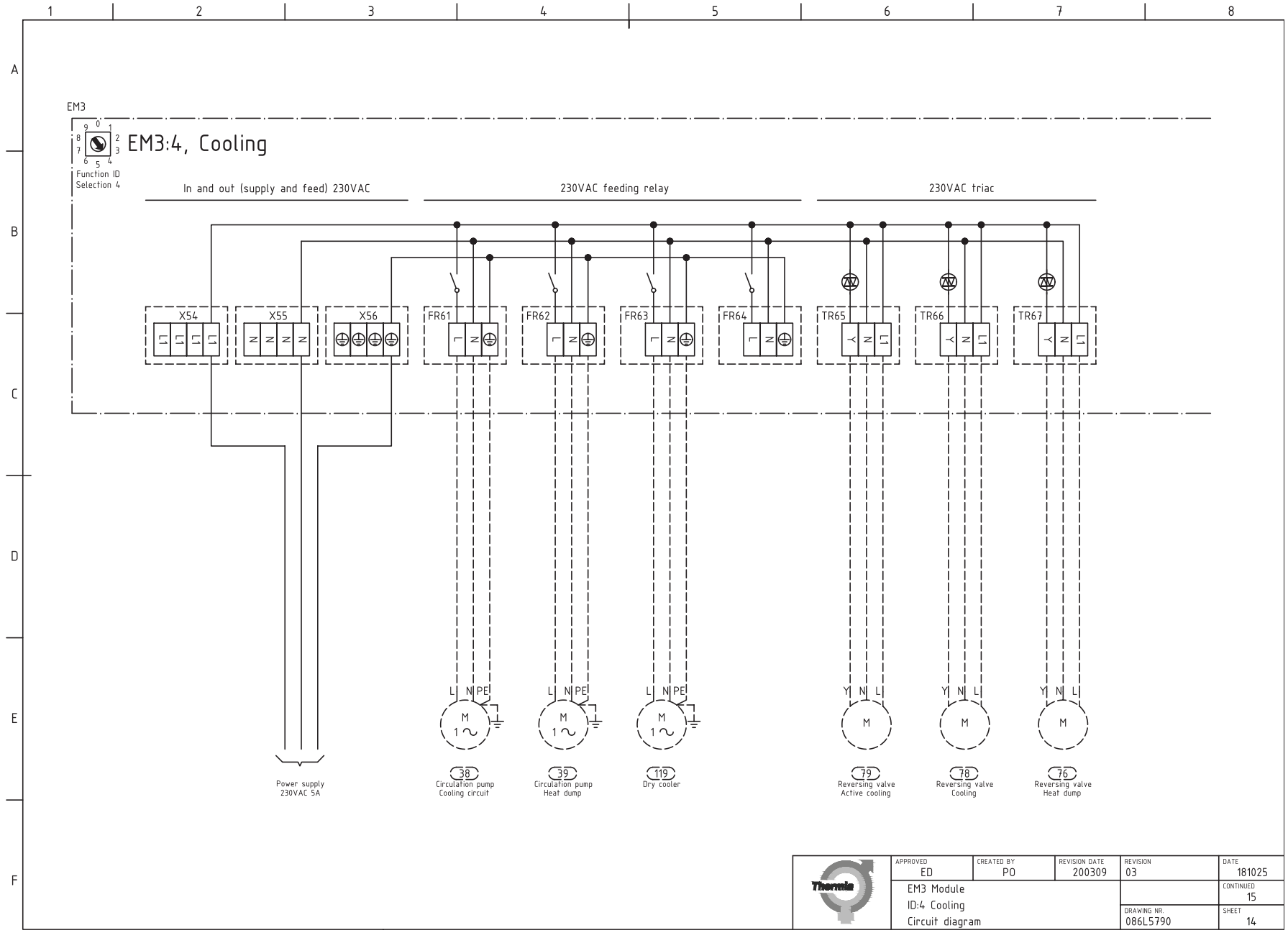
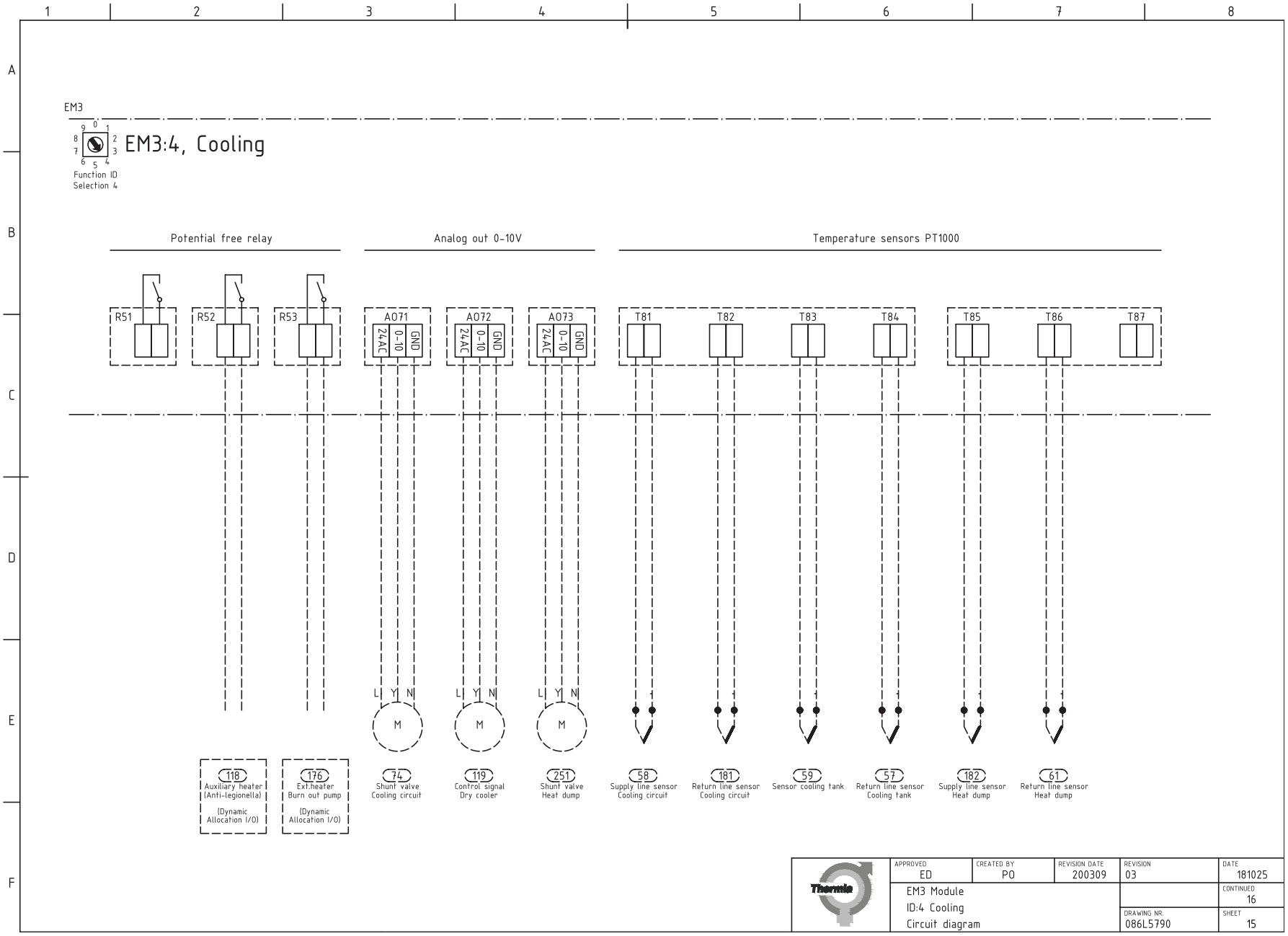
EM3 Module
ID:3 Distribution circuit 4-5
External Connections

DRAWING NR.	SHEET	CONTINUED
086L5790	13	14


EM3
EM3:4, Cooling
Function ID
Selection 4
In and out (supply and feed) 230VAC
230VAC feeding relay
230VAC triac
X54
X55
X56
FR61
FR62
FR63
FR64
TR65
TR66
TR67
Power supply
230VAC 5A
38
Circulation pump
Cooling circuit
39
Circulation pump
Heat dump
119
Dry cooler
79
Reversing valve
Active cooling
78
Reversing valve
Cooling
76
Reversing valve
Heat dump
APPROVED ED
CREATED BY PO
REVISION DATE 200309
REVISION 03
DATE 181025
EM3 Module
ID:4 Cooling
Circuit diagram
DRAWING NR. 086L5790
CONTINUED 15
SHEET 14



APPROVED	CREATED BY	REVISION DATE	REVISION	DATE
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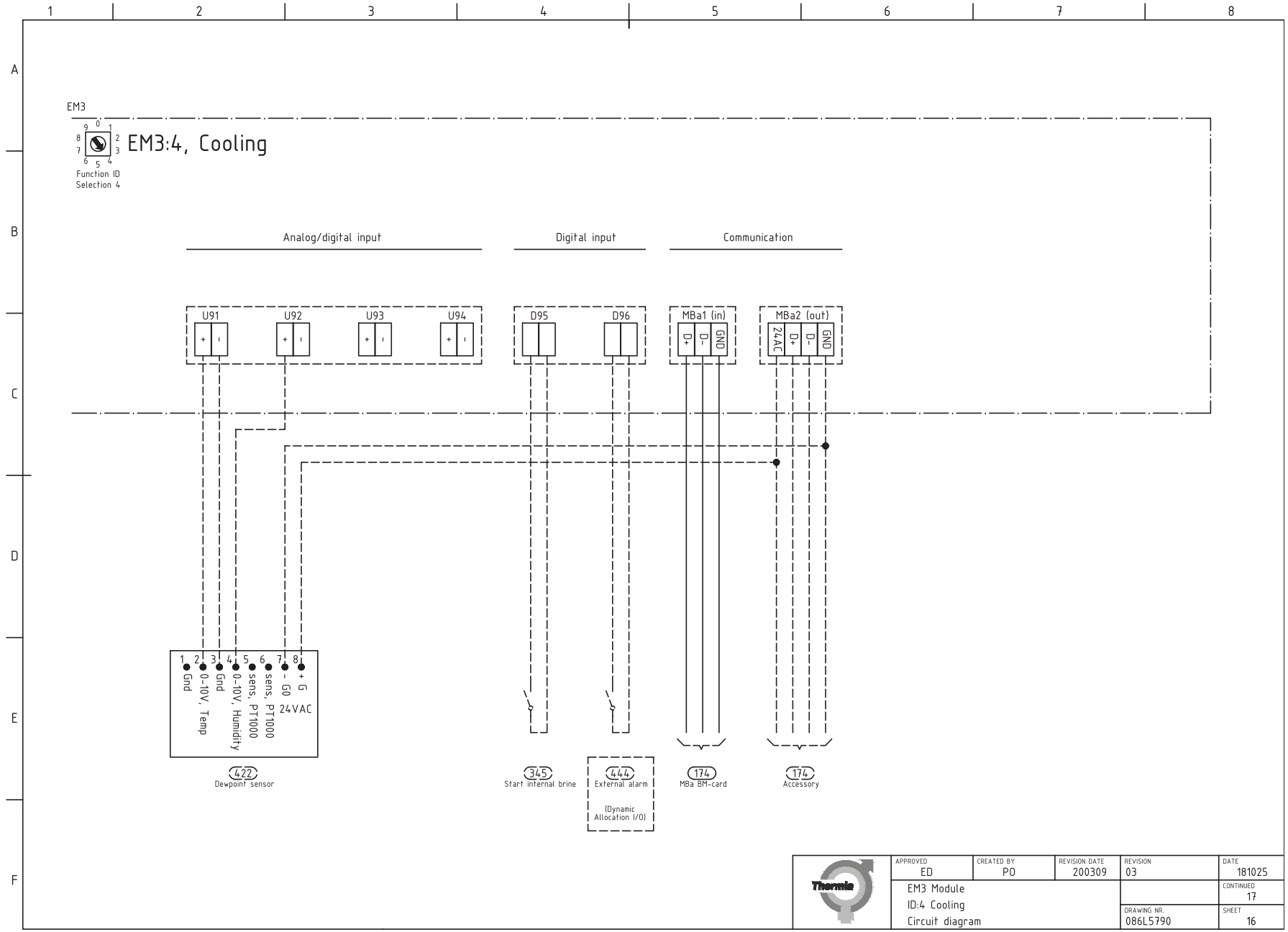
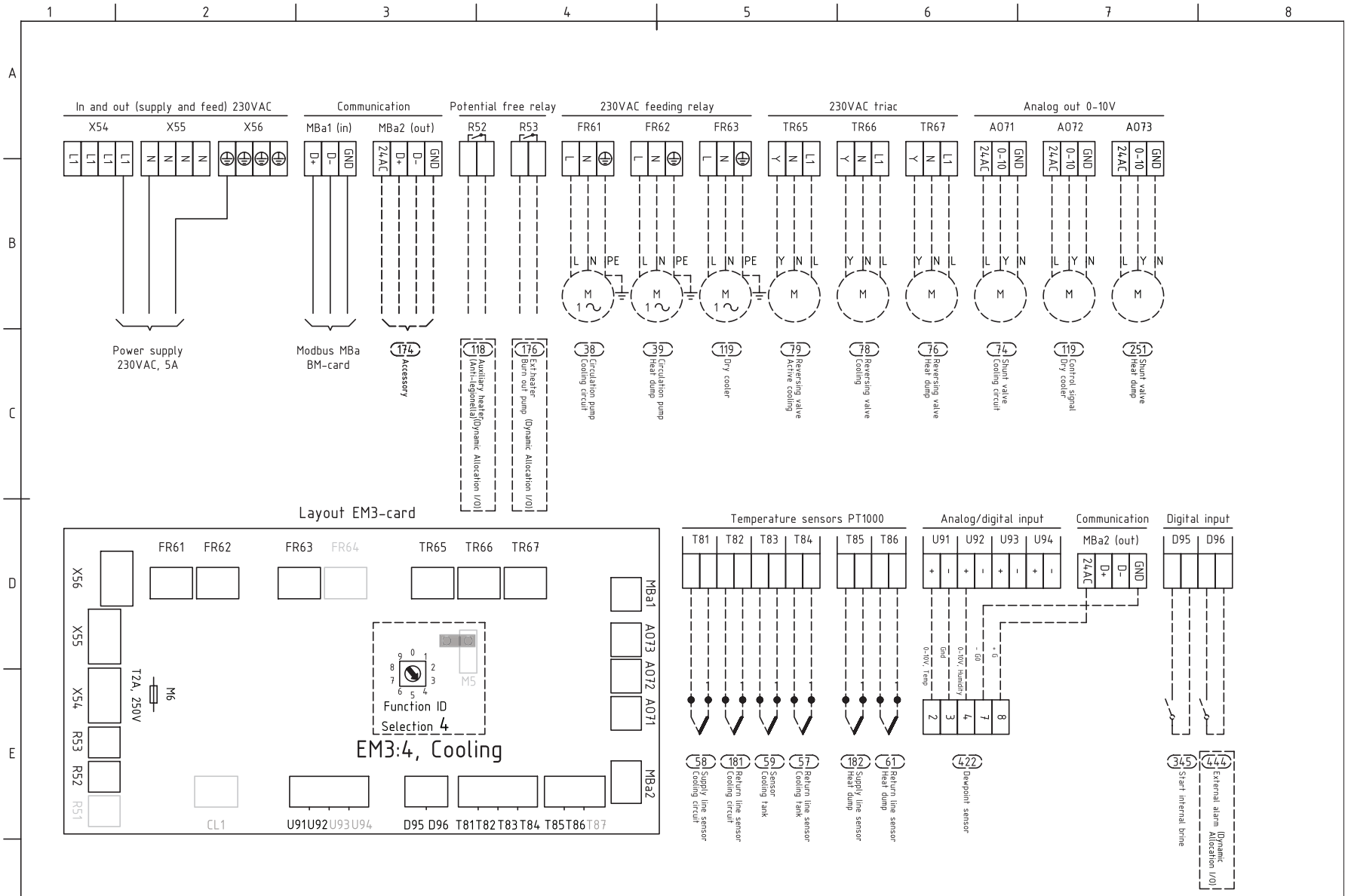
EM3 Module ID:4 Cooling Circuit diagram				CONTINUED 16
			DRAWING NR. 086L5790	SHEET 15


EM3
EM3:4, Cooling
Function ID
Selection 4
Analog/digital input
Digital input
Communication
U91
U92
U93
U94
D95
D96
MBa1 (in)
MBa2 (out)
D+
D-
GND
24VAC
1 Gnd
2 0-10V, Temp
3 Gnd
4 0-10V, Humidity
5 sens, PT1000
6 sens, PT1000
7 - G0
8 + G
24VAC
422
Dewpoint sensor
345
Start infernal brine
444
External alarm
(Dynamic Allocation I/O)
174
MBa BM-card
174
Accessory
APPROVED ED
CREATED BY PO
REVISION DATE 200309
REVISION 03
DATE 181025
EM3 Module
ID:4 Cooling
Circuit diagram
CONTINUED 17
DRAWING NR. 086L5790
SHEET 16



APPROVED	CREATED BY	REVISION DATE	REVISION	DATE
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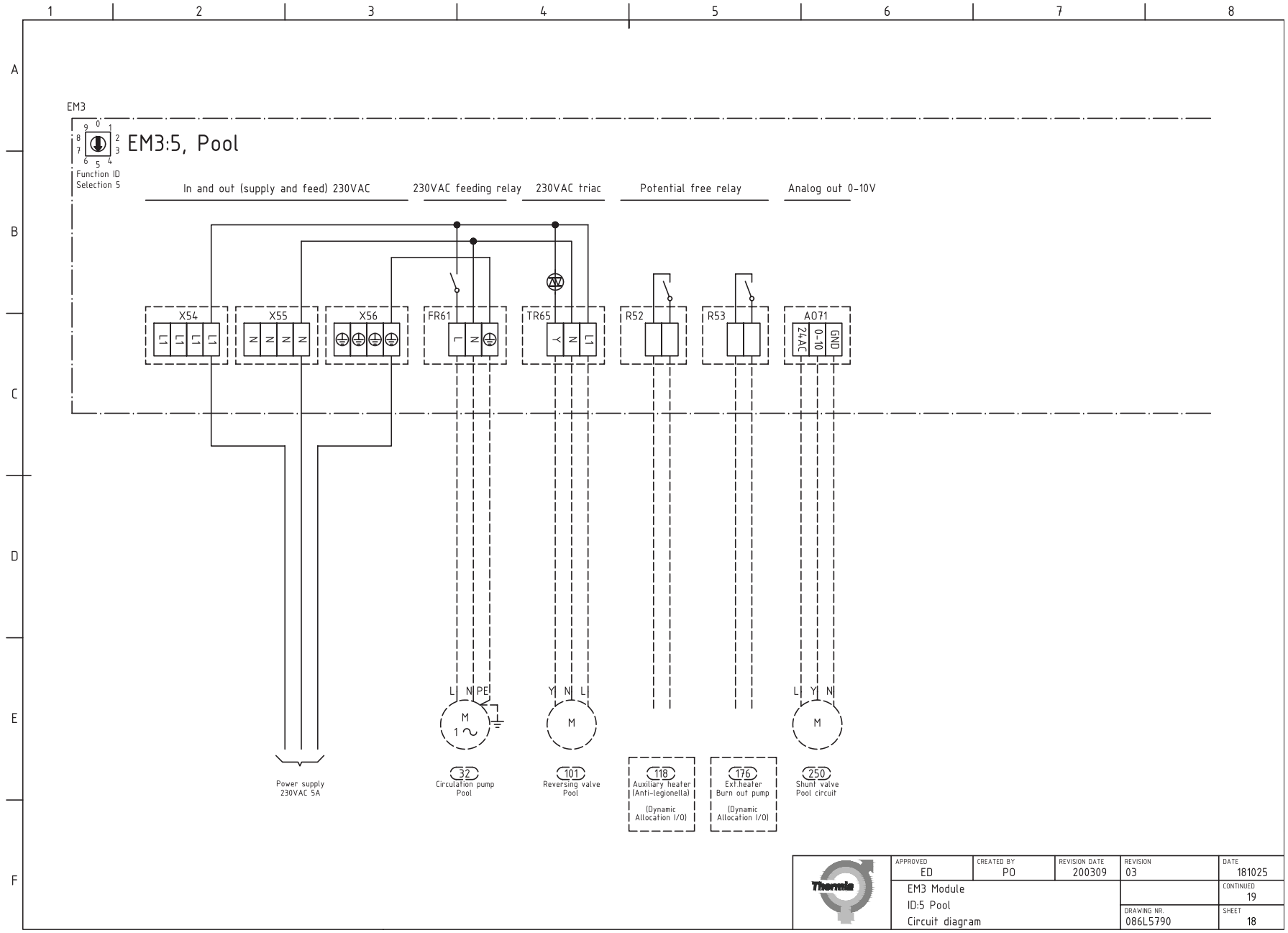
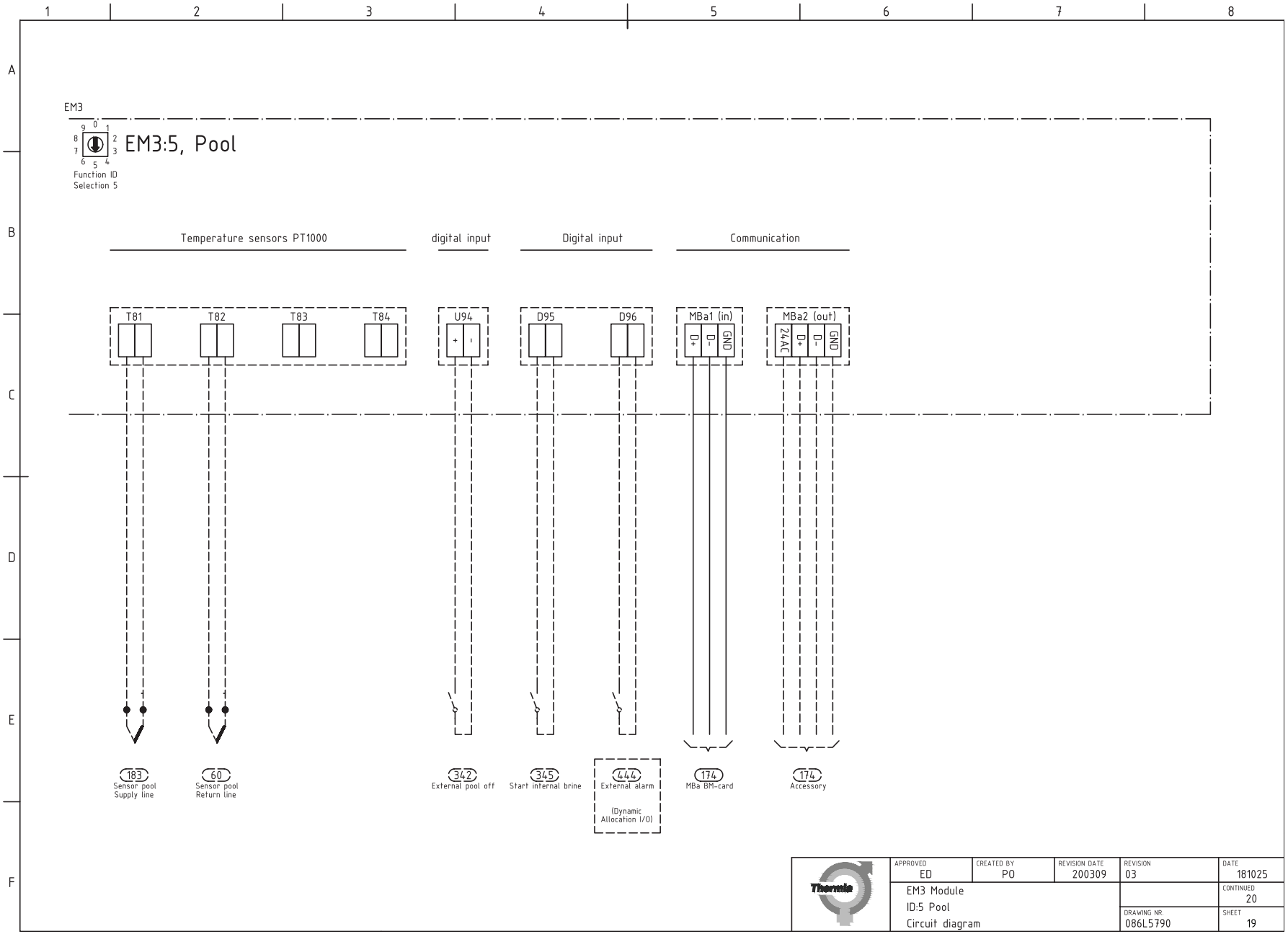
EM3 Module ID:4 Cooling External Connections				CONTINUED 18
			DRAWING NR. 086L5790	SHEET 17


EM3
EM3:5, Pool
Function ID
Selection 5
In and out (supply and feed) 230VAC
230VAC feeding relay
230VAC triac
Potential free relay
Analog out 0-10V
X54
X55
X56
FR61
TR65
R52
R53
A071
Power supply
230VAC 5A
32
Circulation pump
Pool
101
Reversing valve
Pool
118
Auxiliary heater
(Anti-legionella)
(Dynamic
Allocation I/O)
176
Ext.heater
Burn out pump
(Dynamic
Allocation I/O)
250
Shunt valve
Pool circuit
APPROVED ED
CREATED BY PO
REVISION DATE 200309
REVISION 03
DATE 181025
EM3 Module
ID:5 Pool
Circuit diagram
CONTINUED 19
DRAWING NR. 086L5790
SHEET 18



APPROVED	CREATED BY	REVISION DATE	REVISION	DATE
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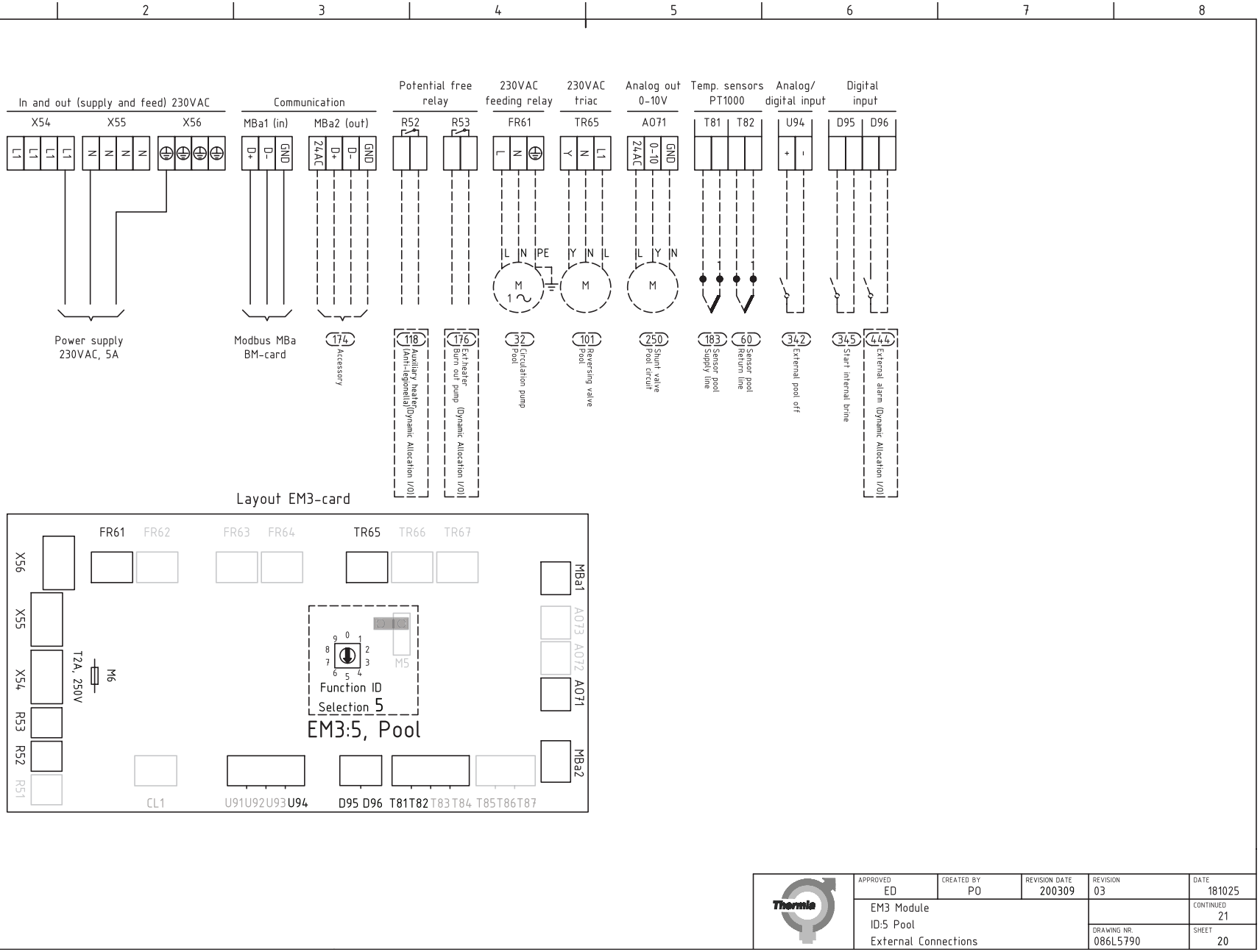
EM3 Module ID:5 Pool Circuit diagram				CONTINUED 20
			DRAWING NR. 086L5790	SHEET 19



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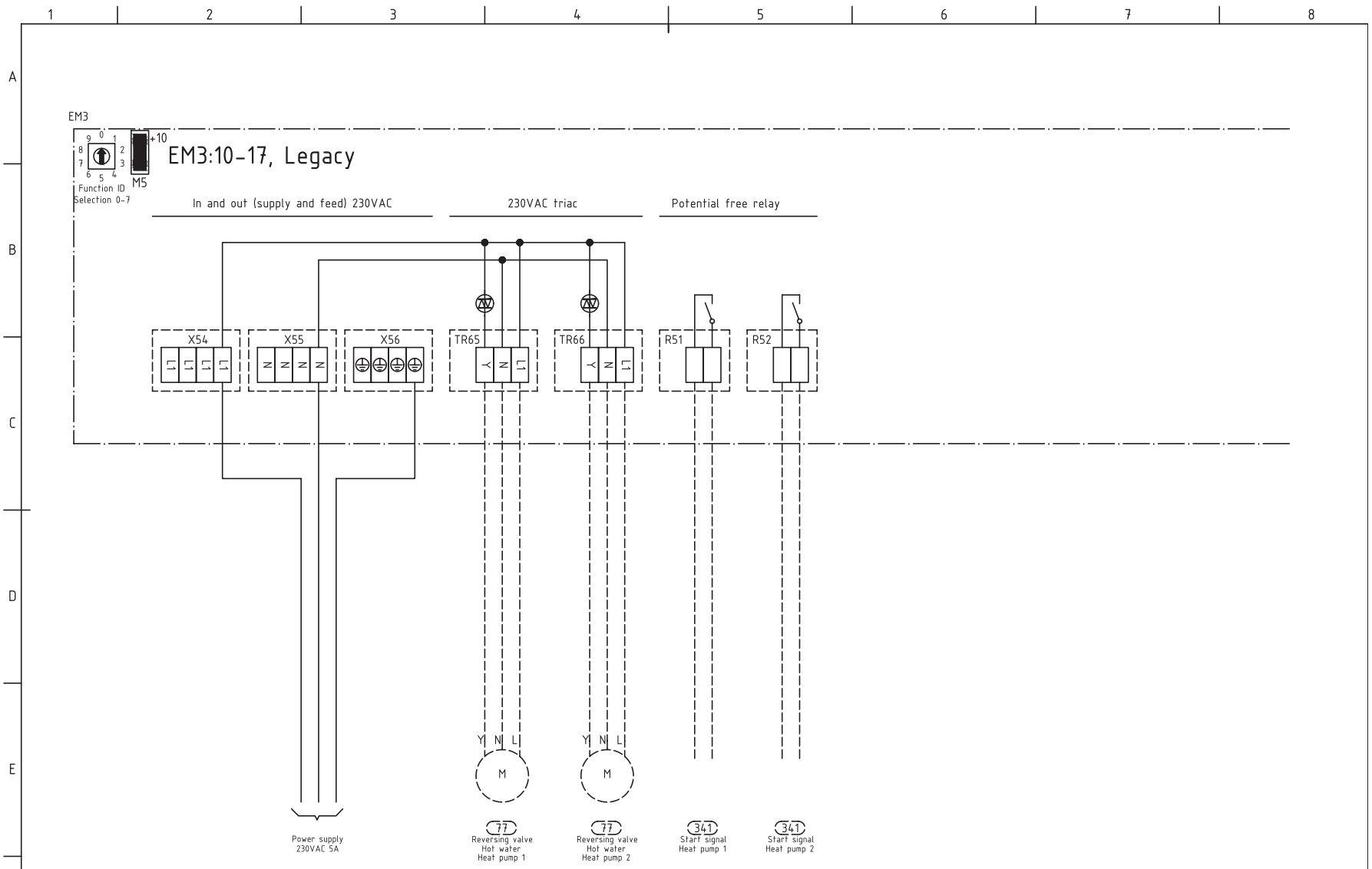
EM3 Module ID:5 Pool External Connections				CONTINUED 21	
				DRAWING NR. 086L5790	SHEET 20



APPROVED	CREATED BY	REVISION DATE	REVISION	DATE
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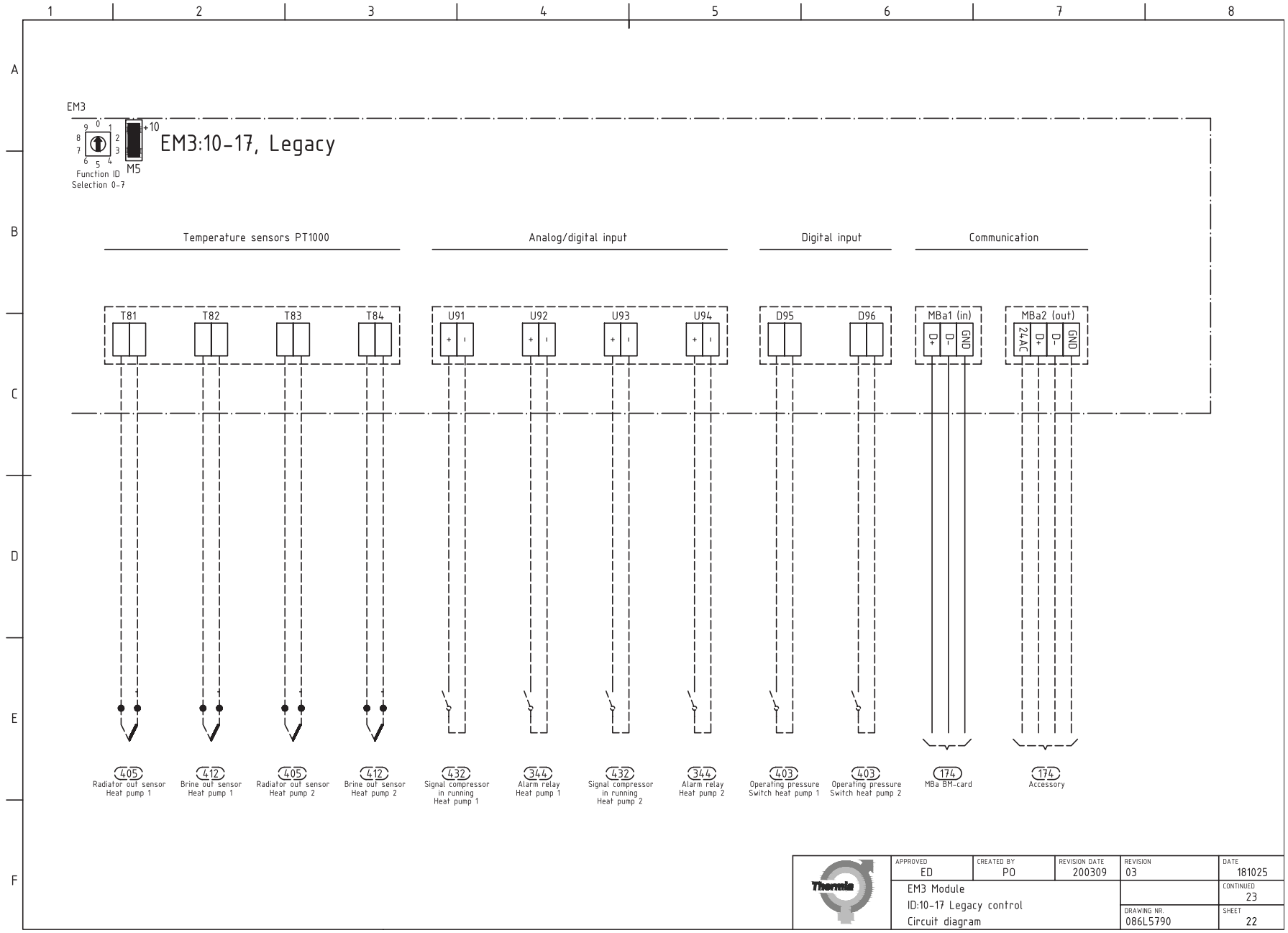
EM3 Module
ID:10-17 Legacy control
Circuit diagram

DRAWING NR.	SHEET
086L5790	21

CONTINUED 22



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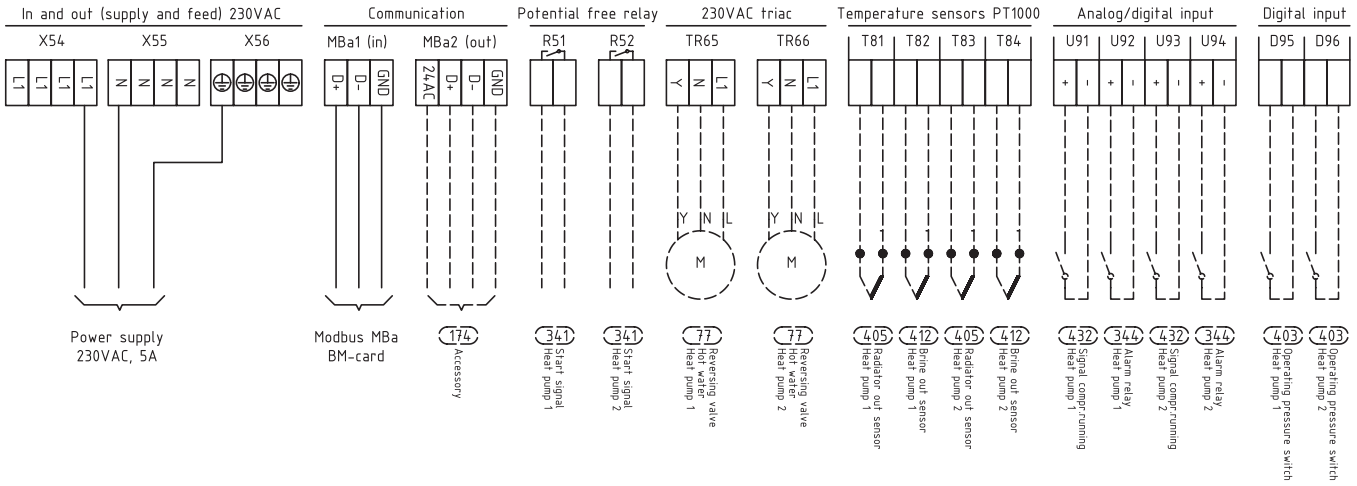
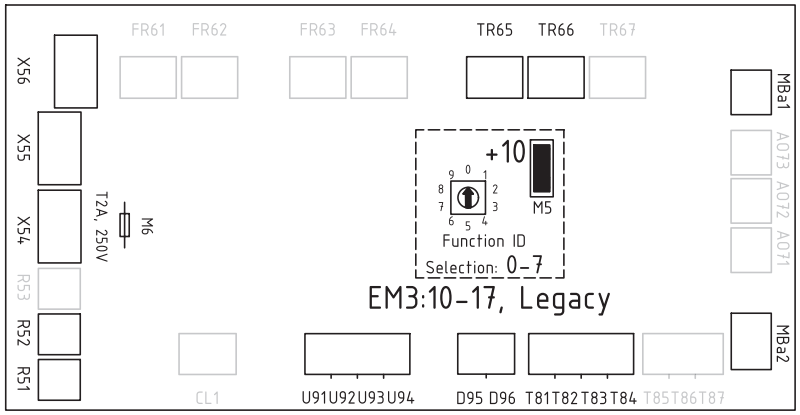
EM3 Module ID:10-17 Legacy control Circuit diagram				CONTINUED 23	
			DRAWING NR. 086L5790	SHEET 22	



Layout EM3-card



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EM3 Module
ID:10-17 Legacy control
External Connections

CONTINUED: -
DRAWING NR.: 086L5790
SHEET: 23

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