CLADE

Elm

Standard & Low Noise

75/60kW

105/70kW

Installation Manual

PD-Elm-03

Version: 2.0

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Contents

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Safety Precautions

- Thoroughly read the following safety precautions prior to use.
- Observe these precautions carefully to ensure safety.

⚠ **WARNING**	Indicates a risk of death or serious injury
⚠ **CAUTION**	Indicates a risk of injury or structural damage
⚠ **IMPORTANT**	Indicates a risk of damage to the unit or other components in the system

General

⚠ **WARNING**

Do not use refrigerant other than the type indicated in the manuals provided with the unit and on the nameplate.
Doing so may cause the unit or pipes to burst, or result in explosion or fire during use, during repair, or at the time of disposal of the unit. It may also be in violation of applicable laws.
CLADE ENGINEERING SERVICES LTD cannot be held responsible for malfunctions or accidents resulting from the use of the wrong type of refrigerant.
Do not install the unit in a place where large amounts of oil, steam, organic solvents, or corrosive gases, such as sulfuric gas, are present or where acidic/alkaline solutions or sprays containing Sulphur are used frequently.
These substances can compromise the performance of the unit or cause certain components of the unit to corrode, which can result in refrigerant leakage, water leakage, injury, electric shock, malfunctions, smoke, or fire.
Do not try to defeat the safety features of the unit or make unauthorized setting changes.
Forcing the unit to operate by defeating the safety features of the devices such as the pressure switch or the temperature switch, making unauthorized changes to the switch settings, or using accessories other than the ones recommended by CLADE ENGINEERING SERVICES LTD may result in smoke, fire, or explosion.
To reduce the risk of fire or explosion, do not use volatile or flammable substances as a heat carrier.
To reduce the risk of burns or electric shock, do not touch exposed pipes and wires.
To reduce the risk of shorting, current leakage, electric shock, malfunctions, smoke, or fire, do not splash water on electric parts.
To reduce the risk of electric shock, malfunctions, smoke or fire, do not operate the switches/buttons or touch other electrical parts with wet hands.
To reduce the risk of electric shock and injury from the fan or other rotating parts, stop the operation and turn off the main power before cleaning, maintaining, or inspecting the unit.
Before cleaning the unit, switch off the power.
To reduce the risk of injury, keep children away while installing, inspecting, or repairing the unit.
Children should be supervised to ensure that they do not play with the appliance.
To reduce the risk of burns or frost bites, do not touch the refrigerant pipes or refrigerant circuit components with bare hands during and immediately after operation.
This appliance is not intended for use by persons (including children) with reduced physical, sensory or mental capabilities, or lack of experience and knowledge, unless they have been given supervision or instruction concerning use of the appliance by a person responsible for their safety.
Keep the space well ventilated. Refrigerant can displace air and cause oxygen starvation.
Always replace a fuse with one with the correct current rating.
The use of improperly rated fuses or a substitution of fuses with steel or copper wire may result in fire or explosion.
If any abnormality (e.g., burning smell) is noticed, stop the operation, turn off the power switch, and consult your dealer.
Continuing the operation may result in electric shock, malfunctions, or fire.
Properly install all required covers and panels on the terminal box and control box to keep moisture and dust out. Dust accumulation and water may result in electric shock, smoke, or fire.
Consult an authorized agency for the proper disposal of the unit.

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⚠ CAUTION

Do not operate the unit without panels and safety guards properly installed.
To reduce the risk of injury, do not sit, stand, or place objects on the unit.
Do not connect the makeup water pipe directly to the potable water pipe. Connecting these pipes directly may cause the water in the unit to migrate into the potable water and cause health problems.
To reduce the risk of adverse effects on plants and animals, do not place them where they are directly exposed to discharge air from the unit.
Do not install the unit on or over things that are vulnerable to water damage.
Condensation may drip from the unit.
To prevent environmental pollution, dispose of brine in the unit and cleaning solutions according to the local regulations.
It is punishable by law not to dispose of them according to the applicable laws.
The water heated by the heat pump is not suitable for use as drinking water or for cooking it may cause health problems or degrade food.
In areas where temperature drops to freezing during the periods of non-use, blow the water out of the pipes or fill the pipes with anti-freeze solution. Not doing so may cause the water to freeze, resulting in burst pipes and damage to the unit or the furnishings.
The model of heat pump unit described in this manual is not intended for use to preserve food, animals, plants, precision instruments, or art work.
To reduce the risk of injury, do not touch the heat exchanger fins or sharp edges of components with bare hands.
Do not place a container filled with water on the unit.
If water spills on the unit, it may result in shorting, current leakage, electric shock, malfunction, smoke, or fire.
Always wear protective clothing when touching electrical components on the unit.
Several minutes after the power is switched off, residual voltage may still cause electric shock.
To reduce the risk of injury, do not insert fingers or foreign objects into air inlet/outlet grills.
To reduce the risk of injury, wear protective gear when working on the unit.
In areas where temperature drops to freezing, use an anti- freeze circuit and leave the main power turned on to prevent the water in the water circuit from freezing and damaging the unit or causing water leakage and resultant damage to the furnishings.
Use clean tap water.
The use of acidic or alkaline water or water high in chlorine may corrode the unit or the pipes, causing water leakage and resultant damage to the furnishings.
In areas where temperature can drop low enough to cause the water in the pipes to freeze, operate the unit often enough to prevent the water from freezing.
Periodically inspect and clean the water circuit.
Dirty water circuit may compromise the unit's performance or corrodes the unit or cause water leakage and resultant damage to the furnishings.

Transportation

⚠ WARNING

Lift the unit by using the designated lifting eyes on each side of the unit. Support the unit securely at these four points to keep it from slipping and sliding.
If the unit is not properly supported, it may fall and cause personal injury.

⚠ CAUTION

To reduce the risk of injury, products weighing 20 kg or more should be carried by two or more people.

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Installation

⚠ WARNING

Do not install the unit where there is a risk of leaking flammable gas.
If flammable gas accumulates around the unit, it may ignite and cause a fire or explosion.
Properly dispose of the packing materials.
Plastic bags pose suffocation hazard to children.
The unit should be installed only by personnel certified by Clade Engineering Ltd according to the instructions detailed in the Installation/Operation Manual.
Improper installation may result in refrigerant leakage, water leakage, injury, electric shock, or fire.
Any additional parts must be installed by qualified personnel.
Take appropriate safety measures against wind gusts and earthquakes to prevent the unit from toppling over and causing injury.
Periodically check the installation base for damage.
If the unit is left on a damaged base, it may fall and cause injury.
Be sure to install the unit horizontally, using a level.
If the unit is installed at an angle, it may fall and cause injury or cause water leakage.
Remove packing materials from the unit before operating the unit. Note that some accessories may be taped to the unit. Properly install all accessories that are required.
Failing to remove the packing materials or failing to install required accessories may result in refrigerant leakage, oxygen starvation, smoke, or fire.
The unit should be installed on a surface that is strong enough to support its weight.
As an anti-freeze, use ethylene glycol or propylene glycol diluted to the specified concentration.
The use of other types of anti-freeze solution may cause corrosion and resultant water leakage. The use of flammable anti-freeze may cause fire or explosion.

Pipe Installation

⚠ WARNING

To prevent explosion, do not heat the unit with refrigerant gas in the refrigerant circuit.

⚠ CAUTION

Check that no substance other than the specified refrigerant (R744) is present in the refrigerant circuit.
Infiltration of other substances may cause the pressure to rise abnormally high and cause the pipes to explode
To prevent damage from water due to condensation, properly insulate all pipes.
Check for refrigerant leakage at the completion of installation.
Piping work should be performed by a competent person according to the instructions detailed in the Installation Manual.
Improper piping work may cause water leakage and damage.

Electrical Wiring

⚠ WARNING

To reduce the risk of wire breakage, overheating, smoke, and fire, keep undue force from being applied to the wires.
Properly secure the cables in place and provide adequate slack in the cables so as not to stress the terminals.
Improperly connected cables may break, overheat, and cause smoke or fire.
To reduce the risk of injury or electric shock, switch off the main power before performing electrical work.
To reduce the risk of current leakage, overheating, smoke, or fire, use properly rated cables with adequate current carrying capacity.
Keep the exposed part of cables inside the terminal block.
If an exposed part of the cable come in contact with each other, electric shock, smoke, or fire may result.
All electric work must be performed by a qualified electrician according to the local regulations, standards, and the instructions detailed in the Installation Manual.
Capacity shortage to the power supply circuit or improper installation may result in malfunction, electric shock, smoke, or fire.
To reduce the risk of electric shock, smoke, or fire, install an inverter circuit breaker on the power supply to each unit.
Use properly rated breakers and fuses (inverter breaker, Local Switch <Switch + Type-B fuse>, or no-fuse breaker).
The use of improperly rated breakers may result in malfunctions or fire.
Proper grounding must be provided by a licensed electrician. Do not connect the grounding wire to a gas pipe, water pipe, lightning rod, or telephone wire.
Improper grounding may result in electric shock, smoke, fire, or malfunction due to electrical noise interference.

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⚠ CAUTION

To reduce the risk of current leakage, wire breakage, smoke, or fire, keep the wiring out of contact with the refrigerant pipes and other parts, especially sharp edges.
To reduce the risk of electric shock, shorting, or malfunctions, keep wire pieces and sheath shavings out of the terminal block.

Transportation and Repairs

⚠ WARNING

The unit should be moved, disassembled, or repaired only by qualified personnel. Do not alter or modify the unit.
Improper repair or unauthorized modifications may result in refrigerant leakage, water leakage, injury, electric shock, or fire.
After disassembling the unit or making repairs, replace all components as they were.
Failing to replace all components may result in injury, electric shock, or fire.
If the supply cord is damaged, it must be replaced by the manufacturer, its service agent or similarly qualified persons in order to avoid a hazard.

⚠ CAUTION

To reduce the risk of shorting, electric shock, fire, or malfunction, do not touch the circuit board with tools or with your hands, and do not allow dust to accumulate on the circuit board.

IMPORTANT

To avoid damage to the unit, use appropriate tools to install, inspect, or repair the unit
Do not unnecessarily change the switch settings or touch other parts in the refrigerant circuit. Doing so may change the operation mode or damage the unit.
To reduce the risk of malfunctions, use the unit within its operating range.
Do not switch on or off the main power in a cycle shorter than 10 minutes.
Short-cycling the compressor may damage the compressor.
To maintain optimum performance and reduce the risk of malfunction, keep the air pathway clear
To ensure proper operation of the unit, periodically check for proper concentration of anti-freeze.
Inadequate concentration of anti-freeze may compromise the performance of the unit or cause the unit to abnormally stop.
Take appropriate measures against electrical noise interference when installing the heat pumps in hospitals or facilities with radio communication capabilities.
Inverter, high-frequency medical, or wireless communication equipment as well as power generators may cause the heat pump system to malfunction. Heat pump system may also adversely affect the operation of these types of equipment by creating electrical noise.
Check the water system, using a relevant manual as a reference.
Using the system that does not meet the standards (including water quality and water flow rate) may cause the water pipes to corrode.
To reduce the risk of power capacity shortage, always use a dedicated power supply circuit,

1 Technical Specification

1.1 Construction Table

Elm Range		Elm 75/60kW	Elm 105/70kW
REFRIGERATION SIDE			
Compressor Type	-	Reciprocating	
Compressor Qty	Pcs.	1	
Refrigerant	-	Propane (R290)	
Refrigerant Circuits	Pcs.	1	
Variable speed drive (VSD)	Pcs.	1	1
Refrigerant charge	kg	5.0	6.0
No. evaporators	Pcs.	1	
Evaporators Type	-	Flat bed	
Fin Material	-	AL/MG	
Defrost Type	-	Hot Gas	
Defrost medium	-	R290	
Electrical supply	-	3~ 400V 50 HZ	
DIMENSIONS & NOISE			
Elm Low Noise			
Colour	-	RAL7016 Anthracite	
Unit Weight (empty)	kg	1560	2140
Unit Weight (operational)	kg	1590	2175
Sound Power Level $L_{W(A)}$ (dB)	dB	73	75
Elm Standard Noise			
Colour	-	RAL7016 Anthracite	
Unit Weight (empty)	kg	1238	1308
Unit Weight (operational)	kg	1268	1348
Sound Power Level $L_{W(A)}$ (dB)	dB	85	87
Access			
Minimum free space side	mm	1000	1000
Minimum free space front	mm	1000	1000
Minimum free space back	mm	600	600
Minimum free space above	mm	6000	6000
WATER SIDE			
Type of internal exchanger		Stainless steel plate heat exchanger	
Exchanger Water content	l	13.5	13.5
Connections waterside Flow/Return	DN	54mm Copper	67mm Copper
Factory pressure test rating	PN	6	
Connections waterside Pressure Rating	PN	6	
Control Methodology		PICV	
Pressure Drop (A7/W80) 10K TD	kPa	97.3	80.2
Water flow rates			
Nominal dT 10 K	l/s	1.82	2.46
Minimum Water Flow Rate	l/s	0.61	0.82
Minimum water volume in heating	l	1400	1679
Total internal water volume	l	23.3	29.1

FANS SECTION			
Fans type	-	Axial fans	
N° fans	pcs	2	3
Standard air-flow	m^3/h	22680	33840
Additional Static Pressure Available	Pa	0	0
Fan regulation	-	0-10V	
Fan Power Input	kW	2.8	4.2
ELECTRCIAL SECTION			
Total Absorbed Power (at 7°C ambient)	kW	37.8	50.4
Total Current per phase	A	64.3	85.4
Starting Method	-	Soft Start	
Starting Current (at -5°C ambient)	A	33.3	44.5
Total kVA	kVA	44.5	59.3
Electrical supply	-	3~ 400V 50 HZ	
Communication protocol	-	BACNET over IP (optional extra)	
IP-Class	-	IP54	

1.2 Refrigerant Information

1.2.1 Characteristics of R290 refrigerant

The Elm range of heat pumps manufactured by Clade Engineering Systems are equipped with propane (R290). Propane is classified as an A3 refrigerant (low toxicity but highly flammable) and must be handled in accordance with flammable gas safety guidelines.

Propane is odorless in its pure form and is heavier than air. If released in an enclosed or low-lying area, it can accumulate and form a flammable mixture with air. All personnel involved with specification, installation, operation, and maintenance of these units must be fully qualified, competent, and hold any certifications required for work on flammable refrigerants.

Propane is listed with two GWP values to the difference between its theoretical warming impact and its practical behaviour in the atmosphere. Its theoretical GWP, as defined by the IPCC, is approximately 3 and represents propane's inherent ability to absorb infrared radiation, assuming it behaves like long-lived greenhouse gases such as CO_2. However, in real-world applications, propane breaks down rapidly in the atmosphere, typically within two weeks, due to reactions with hydroxyl radicals. This short atmospheric lifetime means it does not accumulate and has a negligible long-term climate impact. As a result, its adjusted GWP over a 100-year timeframe is approximately 0.02, reflecting its true environmental impact in practical use.

Each unit is evacuated and pre-charged at the factory with the correct amount of R290, so no additional charge is required. The refrigerant charge can be found on the PED label.

In the event of component failure or a leak, the system should be stopped immediately. The remaining charge must be reclaimed or vented in a safe, controlled manner, observing all local regulations for flammable refrigerants. See the system maintenance manual for service valve access points and isolation procedures. Once repairs have been made, the system must be thoroughly evacuated and re-charged with the specified quantity of refrigerant as recorded on the PED label.

Model (SN + LN)	Refrigerant (Kg)	Equivalent CO_2 tons (tCO_2e)
Elm 60/75kW	5.1	0.015
Elm 70/150kW	6.0	0.018

Physical characteristics of the R290 refrigerant	
Safety class (ISO)	A3 (Low toxicity, Highly flammable)
GWP ($kg.CO_2e$)	3
Low flammability limit (LFL) (Kg/m^3 @ 60°C)	~0.038 (varies with temperature)
Burning velocity (BV) (cm/s)	~46
Boiling point (°C)	-42
GWP (100 yr ITH)	0.02
ODP (Ozone Layer Depletion)	0
Self-ignition temperature (°C)	470

1.2.2 Gas Leak Detection

The Elm heat pump is supplied with full leak detection safety systems. The design of the heat pump includes enhanced tightness joints and the refrigerant circuit is a sealed system. The design also separates electrical equipment to protect the system from any sources of ignition.

In the unlikely event of component failure or a leak the heat pump will detect a gas escape and shut down operation. Electrical systems will power down at 20% of the LFL (Lower Flammable Limit) except for the ventilation fan within the heat pump housing. The fan will continue to operate to remove any gas from the housing, ensuring any remaining charge is vented to atmosphere in a controlled manner.

The system will require a manual reset in the event of a gas leak shut down event. This prevents the system from automatically restarting until the cause of the leak or leak alarm is fully investigated and resolved.

See system maintenance manual for access points and isolation procedures. Once the issue has been rectified the system would need to evacuated and re-charged with the correct amount of refrigerant as recorded on the PED label.

⚠ WARNING

The designer/installer must consider adequate protection for gas escapes

1.2.3 Hazardous Area Classification (HAC)

We hereby declare that the hazardous area classification for the space above the Elm has been assessed and calculated in accordance with the requirements of:

BS EN IEC 60079-10-1: Explosive atmospheres – Part 10-1: Classification of areas – Explosive gas atmospheres

This assessment has determined that the area directly above the heat pump qualifies as a Zone 2 hazardous area, defined as:

"An area in which an explosive gas atmosphere is not likely to occur in normal operation and, if it does occur, will persist for a short period only."

The classification was based on the following considerations:

- Identification of potential sources of release of flammable refrigerants or gases.
- Evaluation of ventilation conditions and dispersion characteristics.
- Estimation of the frequency and duration of potential explosive atmospheres.
- Application of qualitative and, where appropriate, quantitative methods as outlined in BS EN IEC 60079-10-1 and relevant industry codes.

All relevant documentation, including hazard identification, zone extent drawings, and supporting calculations, has been compiled.

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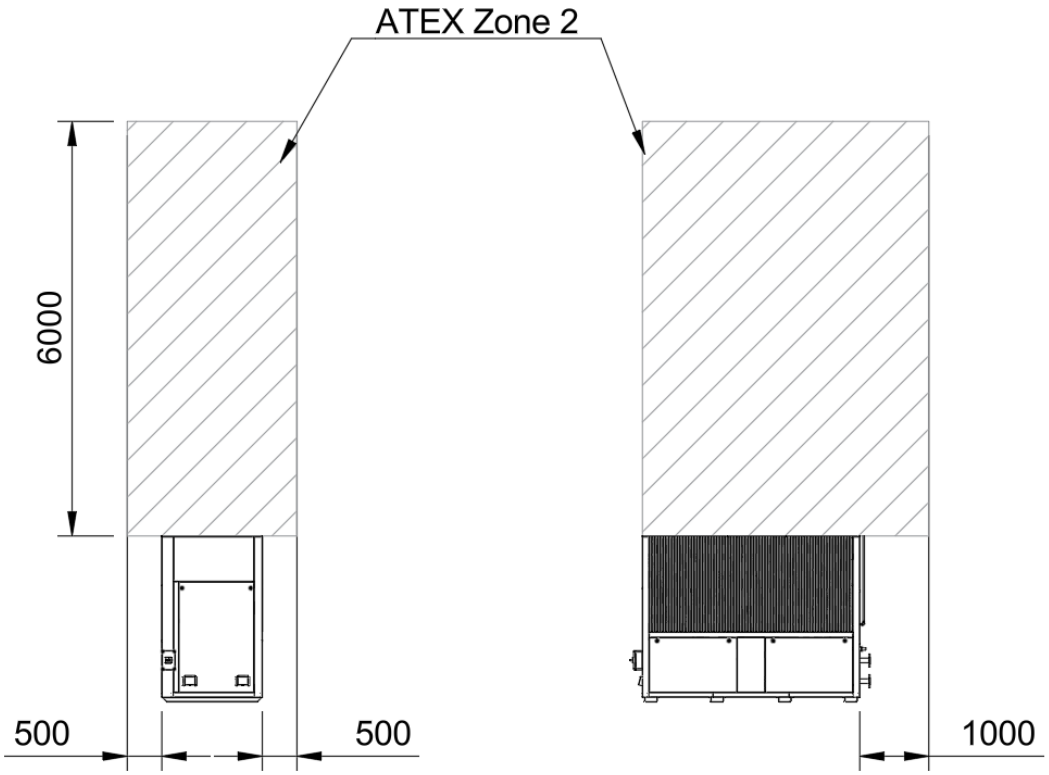
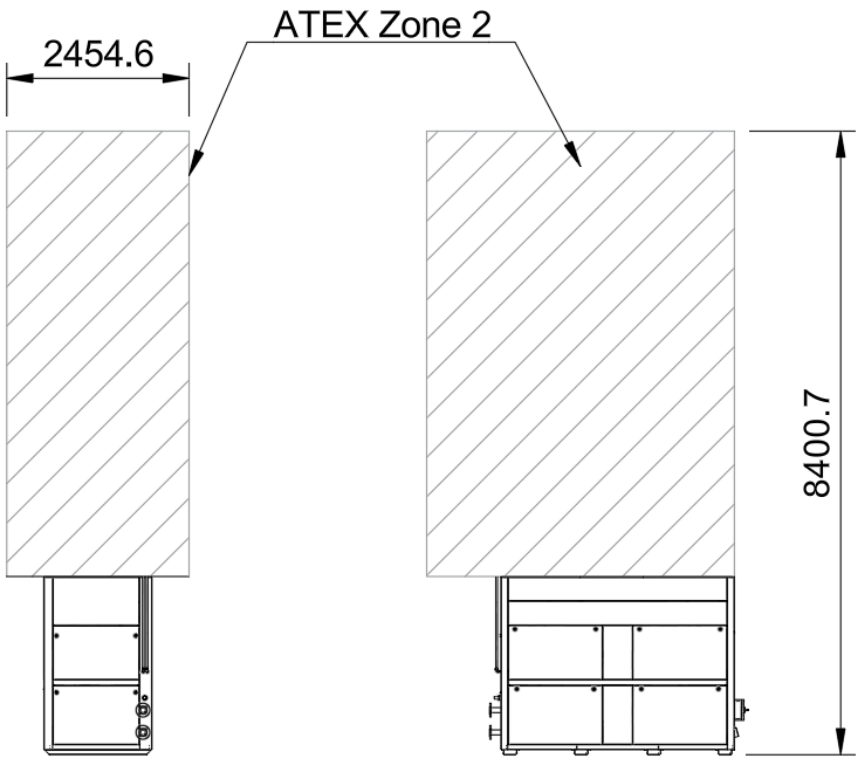
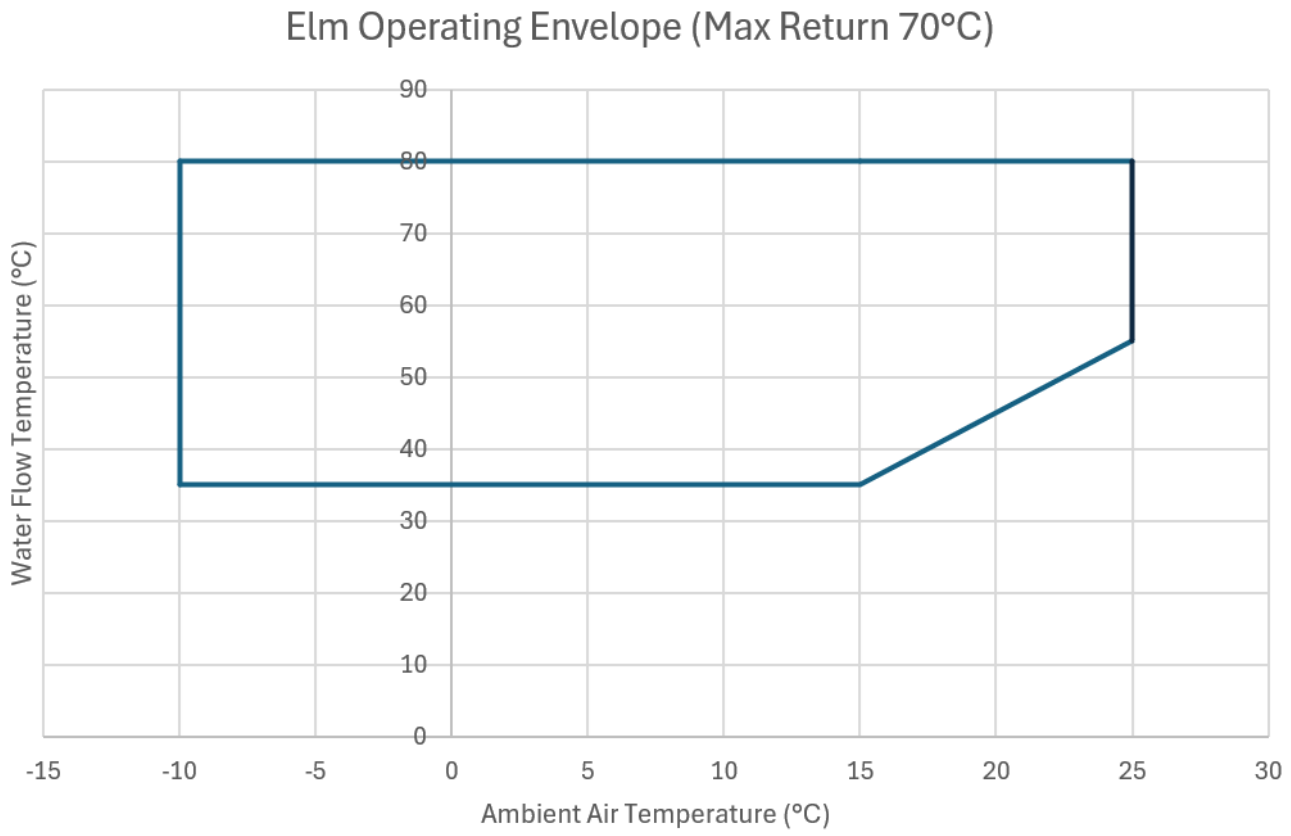
This declaration affirms that the classification has been carried out by competent personnel and that the installation complies with applicable UK legislation, including the Dangerous Substances and Explosive Atmospheres Regulations (DSEAR).

The Zone 2 requirements can be seen in the images below:


ATEX Zone 2
6000
500
500
1000


ATEX Zone 2
2454.6
8400.7

1.3 Operating Ranges



Return temperature range = 20 - 70°C

2 Site Selection

2.1 General notes

2.1.1 Installation criteria:

Accessibility & Space

- Select a location that is safely and easily accessible for maintenance.
- Allow sufficient technical clearance around the unit for its overall dimensions, airflow paths (intake and exhaust), and service access (as specified in this manual).
- Ensure unobstructed airflow by avoiding siting near tall walls, in corners, beneath overhangs, or below ground level where air can stagnate or recirculate.

Structural Support

- Verify that all support points can bear the unit's weight.
- Mount the unit above ground level to facilitate condensate drainage and reduce moisture ingress.
- Align and level all bearing points accurately to prevent vibration and uneven loading.

Environmental Considerations

- Avoid flood-prone areas and account for maximum potential snow levels—ensure snow drift won't block airflow or drainage.
- Protect against debris accumulation (leaves, litter, etc.) on the air coil.
- Avoid siting near strong wind corridors that could impede or exaggerate airflow, and steer clear of nearby heat or pollution sources (e.g. chimneys, flues, vehicle exhausts).
- Prevent cold-air stratification by ensuring intake air remains free-flowing and that expelled air cannot be drawn back in.
- Consult the unit's declared sound power level (dBA) in the technical specifications. Use this to model expected sound pressure levels at neighbouring facades and property boundaries.

Utilities & Drainage

- Confirm that electrical connection runs do not exceed the maximum allowable distance specified by the manufacturer.
- Provide a dedicated condensate drainage system to prevent standing water beneath the unit.
- Ensure water from the unit can be drained properly at all times.

Security & Safety

- If there is a risk of unauthorised access (children, vandalism, wildlife), install appropriate barriers or fencing.
- This unit is designed for outdoor installation only and must not be enclosed indoors.

Final Verification

- After positioning and securing the unit, verify that all space requirements (clearances for airflow, service access, and noise dissipation) outlined in this manual are met.

Adherence to these guidelines will ensure safe installation, effective airflow, and long-term reliability of the outdoor unit.

2.1.2 Structural

- Concrete bases are preferred.
- Raise the base at least 300 mm above ground level to fit hydraulic and electrical connections.
- Check that all supports are level.
- Provide adequate condensate drainage when the unit is in heating mode, ensuring water drains safely away from traffic areas where ice may form.
- Separate the foundation from the building structure to limit noise and vibration transmission.
- Use the factory-provided holes to secure the unit to its foundation.

2.1.3 Positioning

The unit is intended for outdoor use in a permanent, flat orientation, either at ground level or on a roof. In roof installations, verify that the structure supports both the unit's weight and potential maintenance loads.

Minimising vibration:

- Install anti-vibration mounts or neoprene pads under the heat pump support.
- Use flexible joints in the water circuit to reduce transmitted vibration.
- Keep the unit perfectly level.

Key considerations:

- Required service clearances.
- Electrical connection routes.
- Water/hydraulic connection access.
- Potential increases in overall height if optional vibration dampers are used.

2.1.4 Charging lines

Where heat pumps are installed at roof level, ensure that dedicated charging lines are provided. These lines must allow for safe and efficient charging of refrigerant, either during commissioning when pre-charging is not feasible, or for subsequent top-ups during maintenance. The charging lines should be easily accessible from ground or plant level, designed to minimise pressure drop, and clearly identified to avoid confusion with other services.

2.1.5 Pressure Relief Valve Refrigerant Side

PRVs are included on the refrigerant loop within the unit. Any ductwork must be sized by the designer in accordance with EN378.

2.1.6 Condensate

Heat pumps produce significant condensate from defrost cycles. Route condensate away from areas where frozen water could pose hazards. Use a downward-sloping drainpipe to prevent ice buildup. In colder climates, consider trace heating cables to prevent freezing.

2.1.7 Freezing Prevention

In event of the primary pump failing, it is essential to protect all external pipework and equipment from ice formation. Install self-regulating trace heating cables beneath the insulation on external water lines to maintain fluid temperatures above 0 °C, even when the air temperature drops to -25 °C. After commissioning, verify under worst-case conditions that inlet and outlet pipe temperatures remain above freezing. Where trace heaters alone may not suffice, use one or more of the following measures—particularly if outdoor temperatures hover around 0 °C—to avoid permanent damage (which voids warranty):

- Mix the system water with an appropriate concentration of antifreeze glycol.
- Install electric heating cables directly under the insulation on all exposed piping.
- Drain down and isolate the system during extended shutdown periods.

Select self-regulating heaters to prevent local hot spots or overheating and always ensure adequate control and monitoring of pipe temperatures.

2.2 Water quality

2.2.1 New Systems

Before commissioning any new installation, remove the circulator and thoroughly flush the entire system to clear out welding residue, waste, sealants, mineral oils, and other preservatives. Only then should you fill the system with clean, high-quality tap water.

2.2.2 Existing Systems

When replacing or adding a heat pump to an existing system, first drain and flush all pipework before installing the new unit. Flush each section separately, paying special attention to areas prone to debris build-up due to reduced flow, then refill with clean, high-quality tap water. If the water is still unsuitable, install an appropriate filter, such as a coarse (mesh) filter for larger debris or a finer tissue filter for smaller particles.

2.2.3 Water Filter

- Use a filter of ≥30 mesh at the water inlet, positioned for easy cleaning.
- Never remove the filter, as doing so invalidates the warranty.

2.2.4 Exclusions

Warranty coverage does not extend to damage caused by limescale, deposits, or impurities from the water supply, nor to issues stemming from improper system cleaning.

2.2.5 Anti-freeze Solutions

Adding antifreeze increases system pressure drop, and only inhibited (non-corrosive) glycol compatible with the circuit should be used. Do not use different glycol mixture (i.e. ethylene with propylene).

% PROPYLENE GLYCOL BY WEIGHT	5%	10%	15%	20%	25%	30%	35%	40%	45%	50%
Freezing temperature (°C)	-1.6	-3.3	-5.1	-7.6	-9.6	-12.7	-16.4	-21.1	-27.9	-33.5
Safety temperature (°C)	-7.0	-8.0	-10.0	-13.0	-15.0	-18.0	-21.0	-26.0	-33.0	-39.0

2.2.6 Minimum Water Quality Requirements for Elm Units

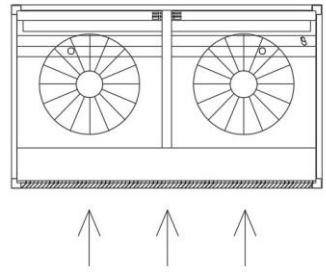
The water system should be maintained to BS 8552. Below is an extract of the figures the minimum performance requirements for on site analysis for closed systems.

Parameter	Typical level in system	Lower detection limit of method (A, B)	Resolution of method (A, B)	Uncertainty of method (A, B)
Conductivity (µS/cm)	100 to 3,000	100	10% MV	20% MV
pH (pH units)	5 to 11	n/a	0.1	0.2
Dissolved oxygen (mg/L O_2)	0.1 to 10	0.1	0.1	0.2
Total alkalinity (mg/L $CaCO_3$)	20 to 500	10	10% MV	20% MV
Total hardness (mg/L $CaCO_3$)	20 to 500	10	10% MV	20% MV
Ammoniacal nitrogen (mg/L N)	1 to 50	0.5	0.5	1.0
Nitrite (NO_2) [c]	0 to 1,000	10	10% MV	20% MV
Molybdate (mg/L MoO_4) [c]	0 to 1,000	10	10% MV	20% MV
Sulfate (as mg/L SO_4) [c]	20 to 200	10	10% MV	20% MV
Total iron (mg/L Fe)	0 to 10	0.2	0.2	0.5
Soluble iron (mg/L Fe)	0 to 10	0.2	0.2	0.5
Total copper (mg/L Cu)	0 to 5	0.2	0.1	0.2

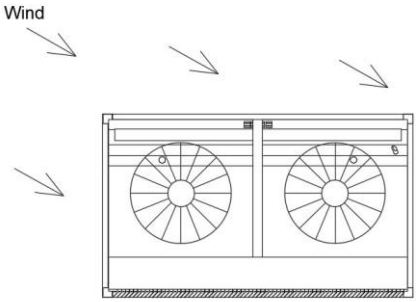
2.3 Protection Against Winds

Protection against the effects of wind should be considered when installing a unit. Whilst the design and operation of unit is designed for the effects of moderate winds, consistent and strong wind will affect the performance of the unit.

Consider the protection of the unit from direct wind across the front grille of the unit. The unit can be orientated to ensure the front on the unit faces away from direct winds as shown below:



Design air flow direction (air intake grille)



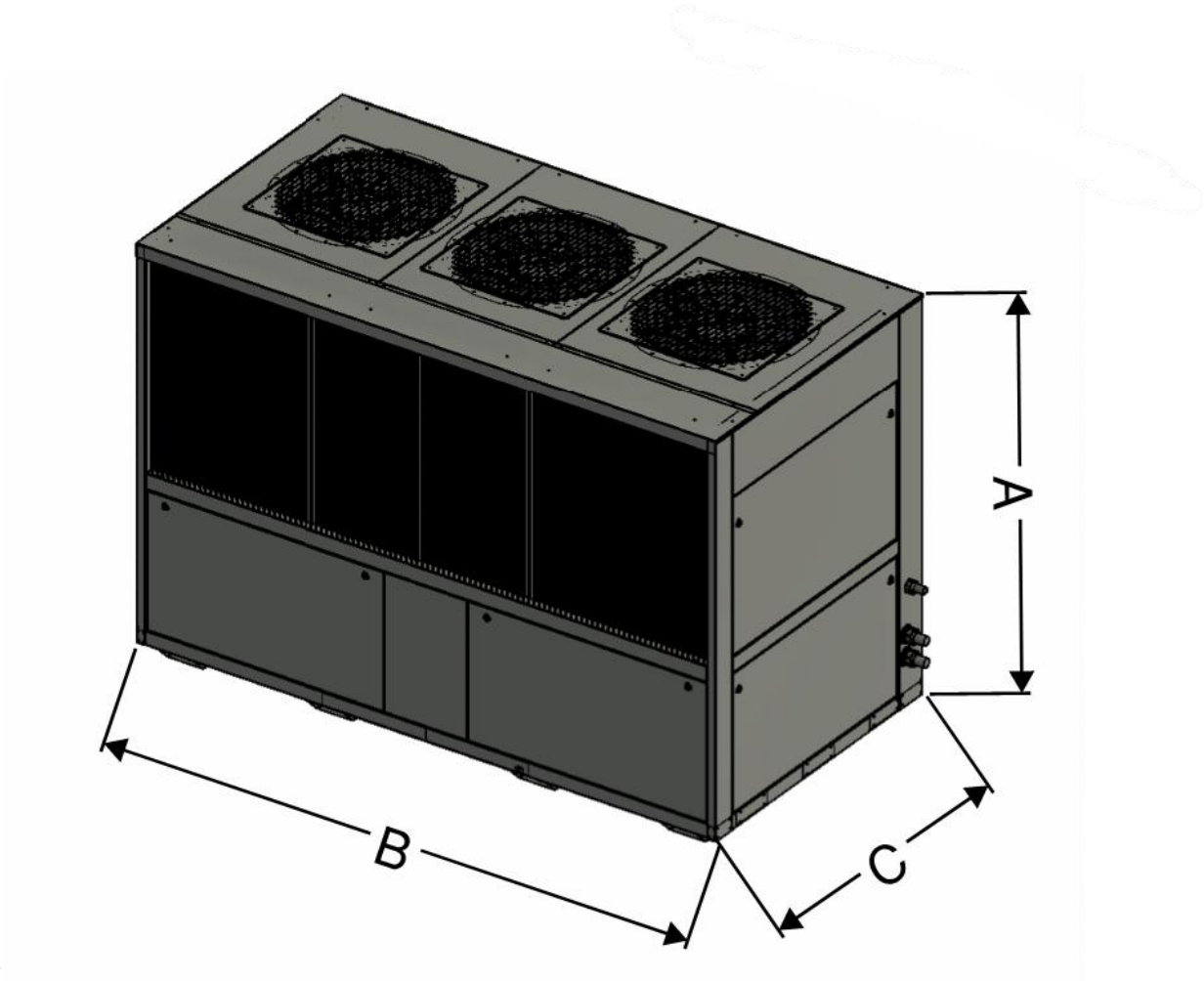
Air intake protected from direct wind

3 Installation Space Requirements

Clade Engineering recommends an allowance of 1.0m perimeter around the front and sides of the unit and 0.6m to the rear of the unit and 6m above the unit.

Adequate access must be available for service and maintenance of the unit with a safe defined route for engineers and care must be taken to ensure that trip hazards are eliminated.

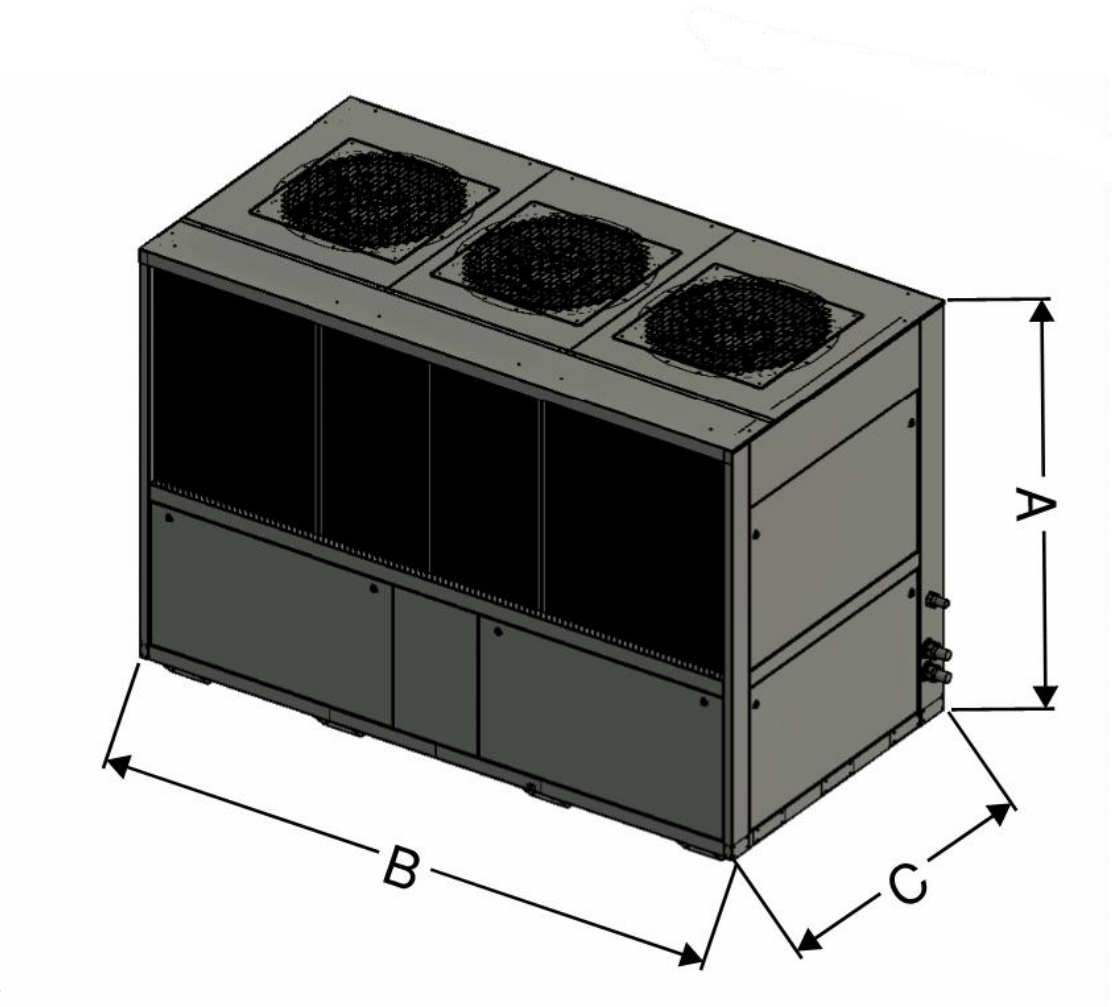
3.1 Dimensions Standard Nosie



`

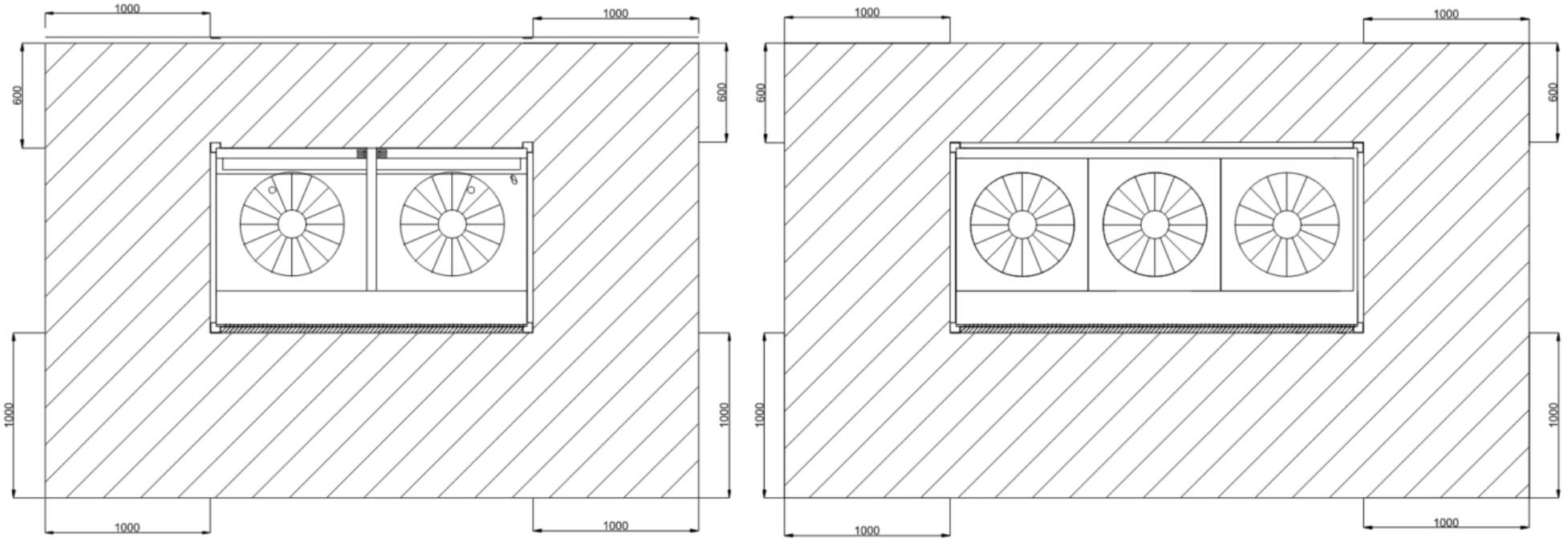
Unit	Height 'A' (mm)	Length 'B' (mm)	Width 'C' (mm)	Operating Weight (kg)	Shipping Weight (kg)
Elm 75/60kW SN	2057	2354	1455	1245	1238
Elm 105/70kW SN	2057	3144	1455	1318	1308

3.2 Dimensions Low Noise



Unit	Height 'A' (mm)	Length 'B' (mm)	Width 'C' (mm)	Operating Weight (kg)	Shipping Weight (kg)
Elm 75/60kW LN	2400	2354	1455	1570	1560
Elm 105/70kW LN	2400	3144	1455	2150	2140

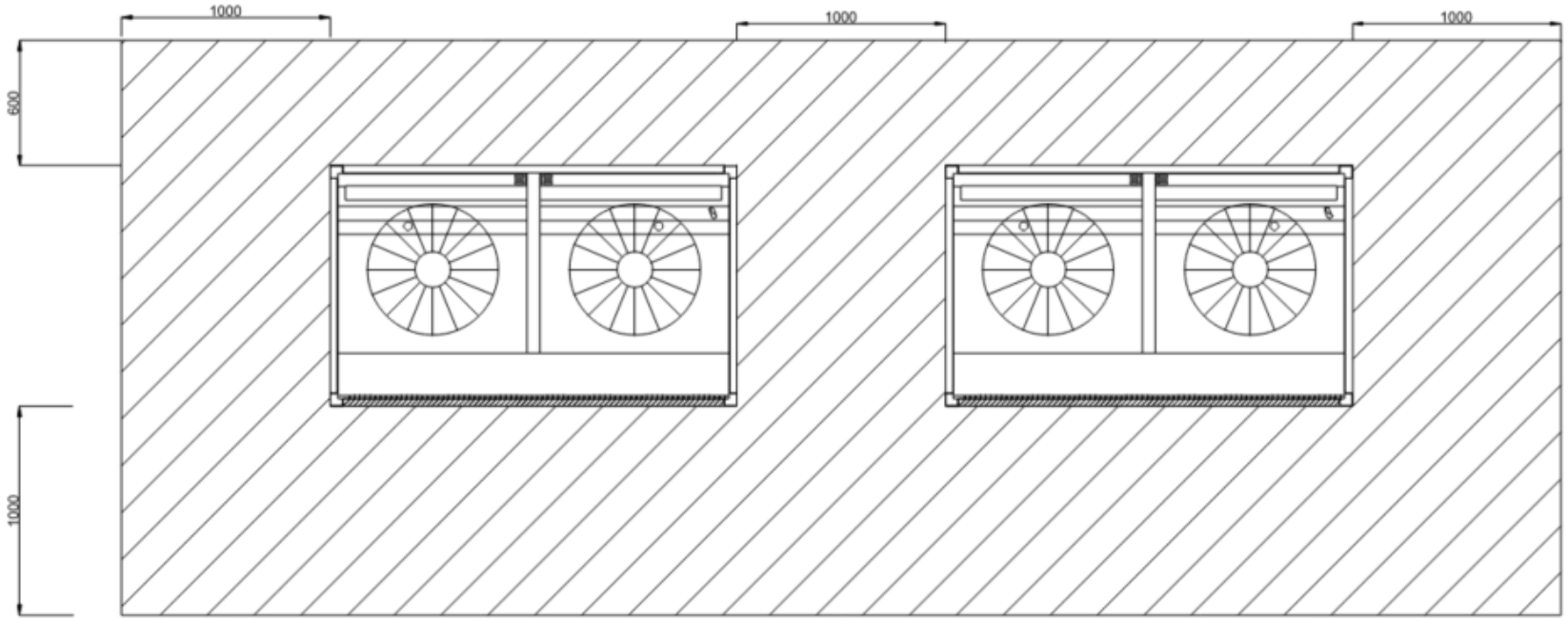
3.2.1 Single Unit Installation



Note. 1 Meter around front and sides to be kept clear to allow access to heat pump, and 0.6 meters at the back of the unit away from other units or walls, shown in hatched region.

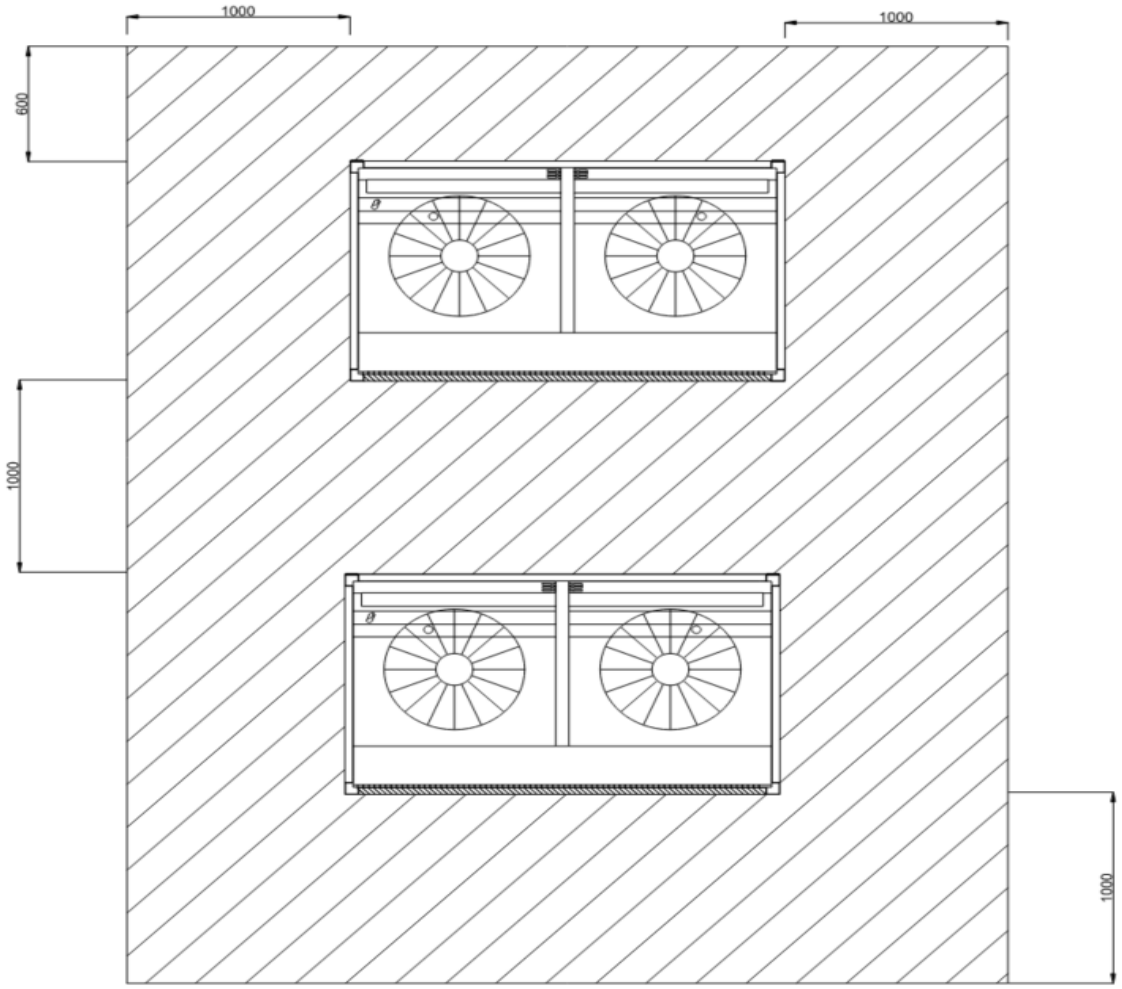
3.2.2 Multiple Unit Installation

When installing multiple units, make sure to take into consideration factors such as providing enough space for people to pass through, ample space between blocks of units, and sufficient space for airflow. Side by side installation, allow access to side of each unit for access.



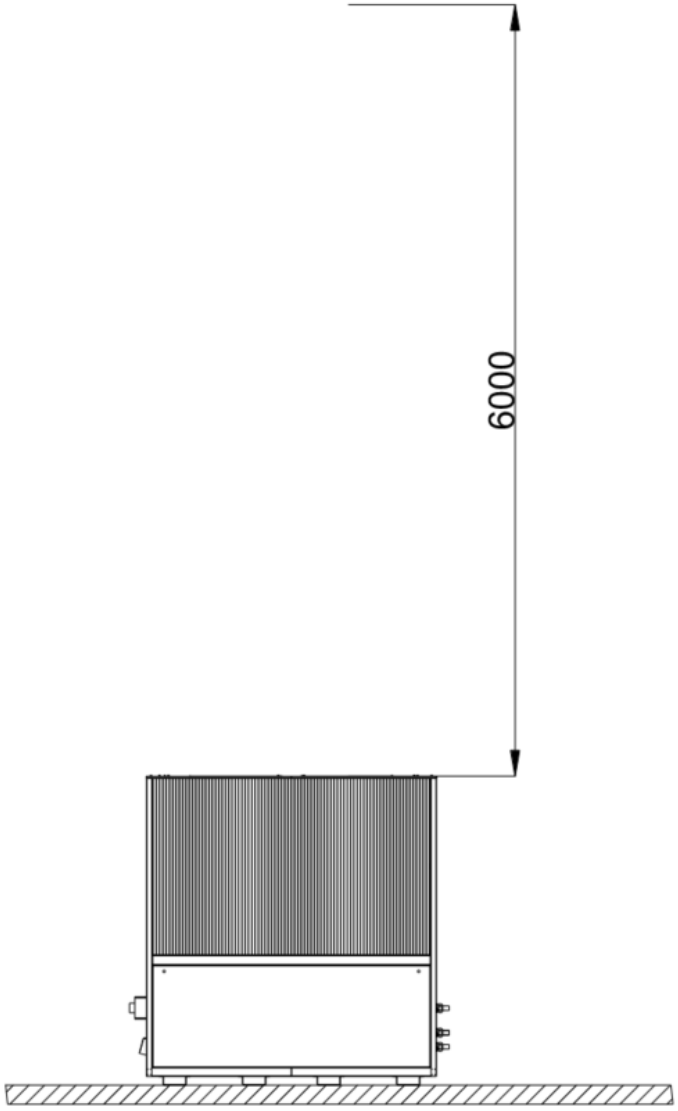
Note. 1 Meter around front and sides to be kept clear to allow access to heat pump, and 0.6 meters at the back away from other units or walls, shown in hatched region.

Units can be placed front to back, ensuring there is 1000mm between the front and back of the units. Please ensure no pipework runs over or across the equipment's access panels, as this can hinder routine inspections and servicing. Likewise, the unit should not installed beneath a dedicated shelter or roof.



Note. 1 Meter to be kept clear to allow access to heat pump, shown in hatched region.

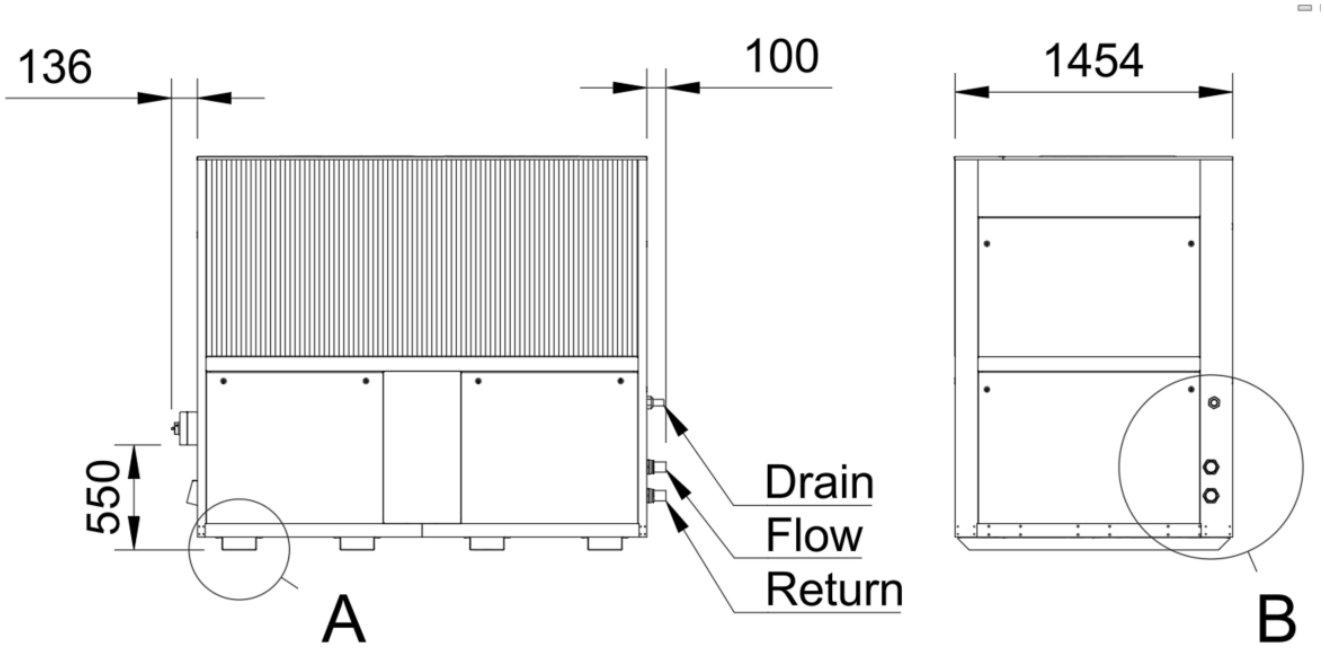
3.2.3 Vertical Clearance

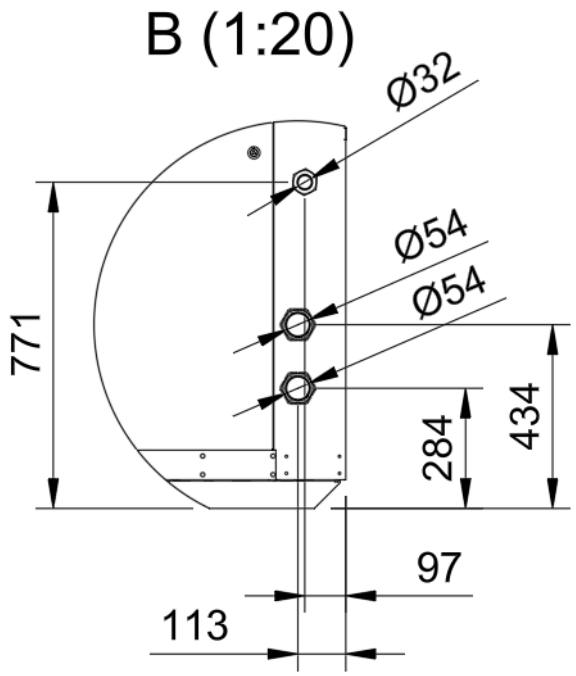


3.3 Service Connections

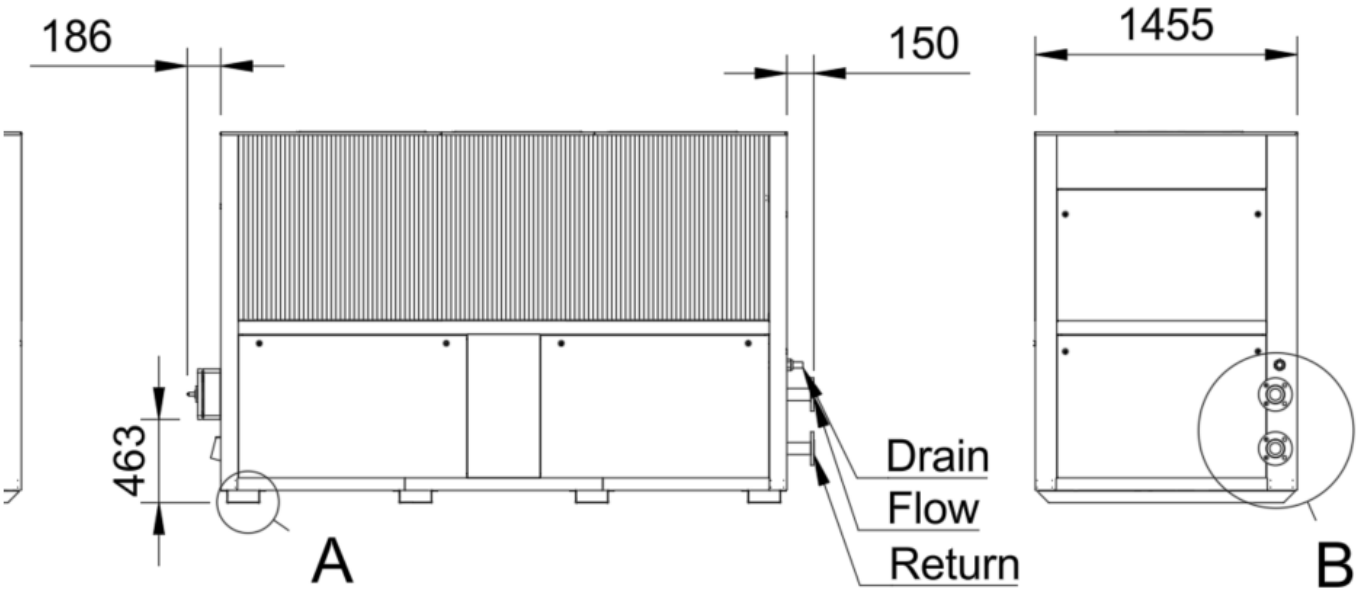
When selecting a location for the unit(s) consideration of the service connection positions is required. All water service connections are located on the right hand side panel of the heat pump and electrical on the left hand side panel of the heat pump.

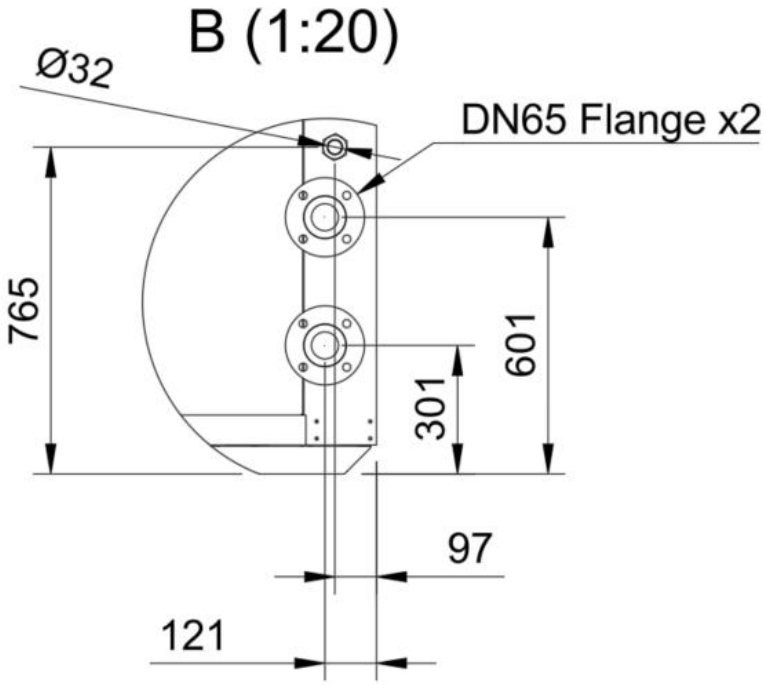
3.3.1 Elm 75/60 (SN + LN) kW





3.3.2 Elm 105/70 (SN + LN) kW





4 Unit Installation

4.1 Delivery & Unpacking

Clade Engineering Systems manufactures these units with provisions for forklift tines or crane/Hiab lifting straps. Only qualified personnel should conduct all lifting operations.

The base mounting frames are designed so that straps can be passed underneath and between the mounting points. Refer to the following section for specific frame identification. It is advisable to use a spreader bar during lifting to prevent straps from damaging the aluminium grille at the front of the unit.

The image below shows the recommended configuration of lifting straps to lift the unit.

If the equipment arrives damaged, the recipient must notify the supplier immediately. Record any issues on the delivery sheet before signing and take photographs for evidence. If concealed damage is discovered after unpacking, it must be reported within seven working days of receipt for any claim to be valid. The recipient is responsible for compiling all evidence and submitting it to the supplier.

4.2 Heat Pump Installation

Install and operate the unit strictly following all instructions provided in this manual, along with any relevant legislation and health and safety directives. The installation area must have sufficient ventilation and feature a level, structurally sound surface capable of supporting the total weight of the system.

Securely fasten the unit to its base using bolts that prevent movement and vibration transmission into the connected system. After the unit is fixed in place, remove the transportation bolts from the internal base plate to allow for proper operation.

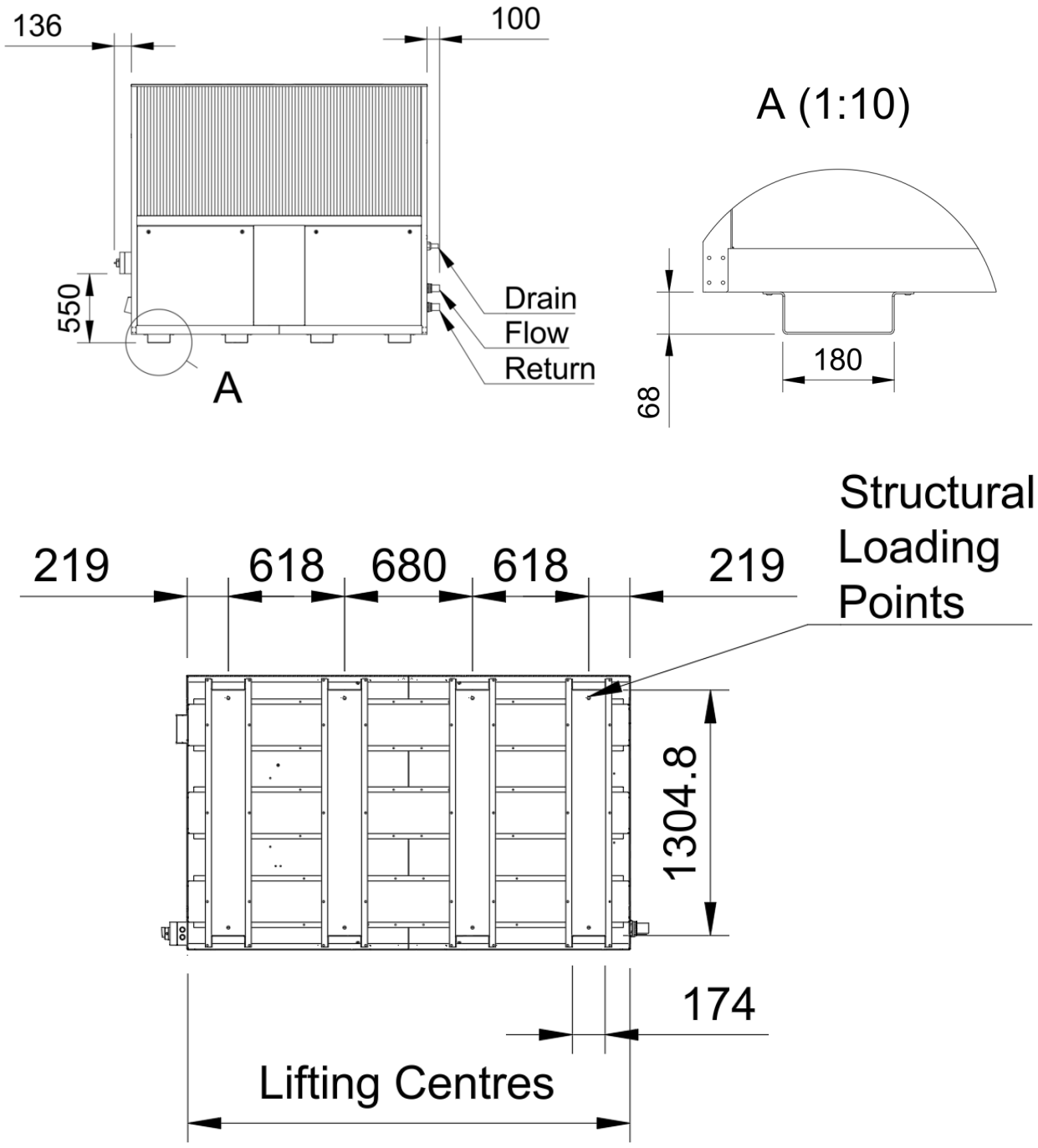
Clade Engineering recommends an allowance of 1.0m perimeter around the front and sides of the unit and 0.6m around the back. Adequate access must be available for service and maintenance of the unit with a safe defined route for engineers and care must be taken to ensure that trip hazards are eliminated.

The electrical supplies must comply with the requirements of the latest IEE regulations and the supply must be correctly rated for the unit.

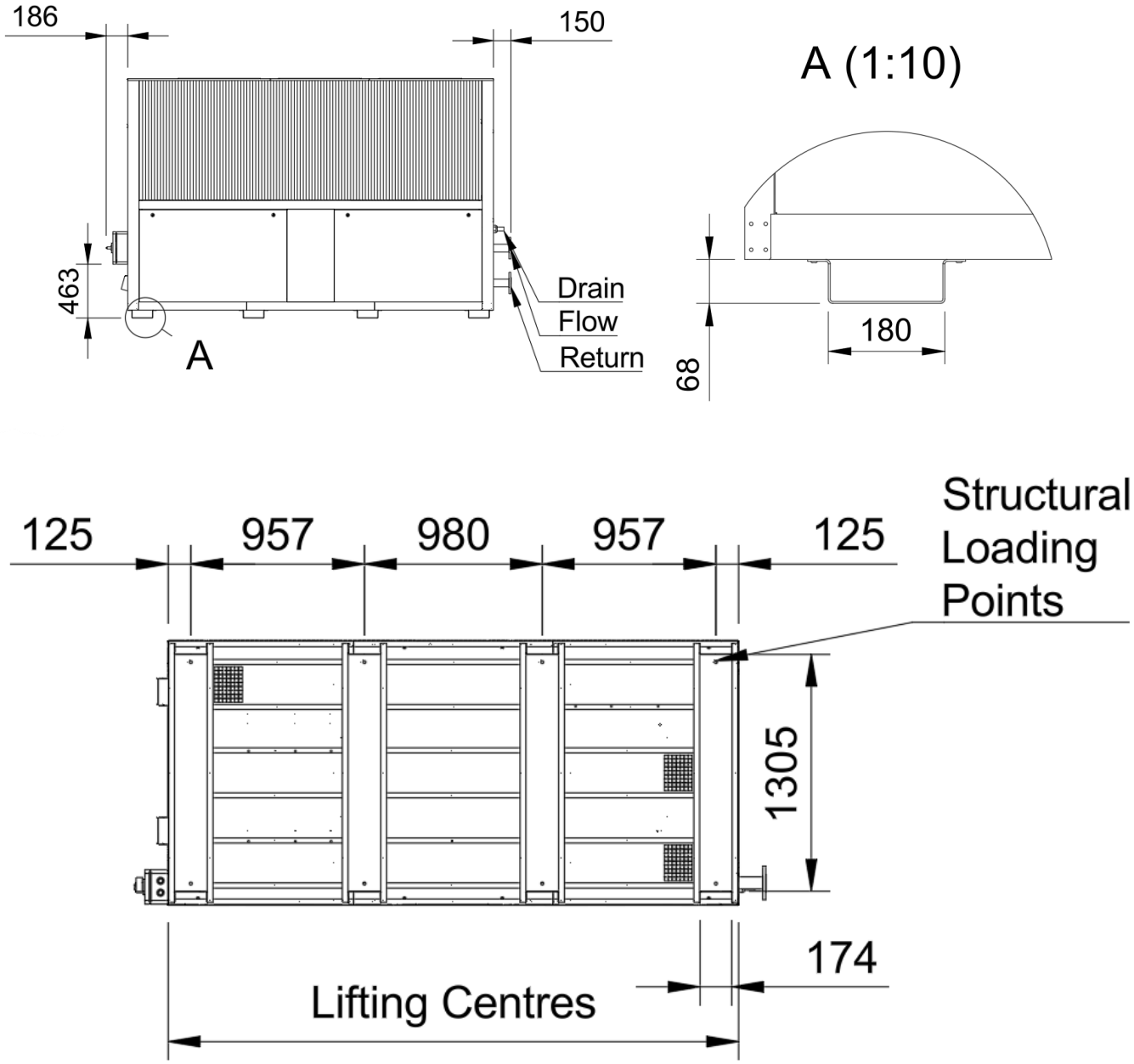
The drainpipe connection should be installed with a downward inclination to prevent drain water from freezing in the winter. For cold climate installations it is recommended that a drain heater tape is used to prevent the drain water from freezing.

4.3 Lifting Centers and Structural Loading Points

4.3.1 Elm 75/60 (SN + LN) kW

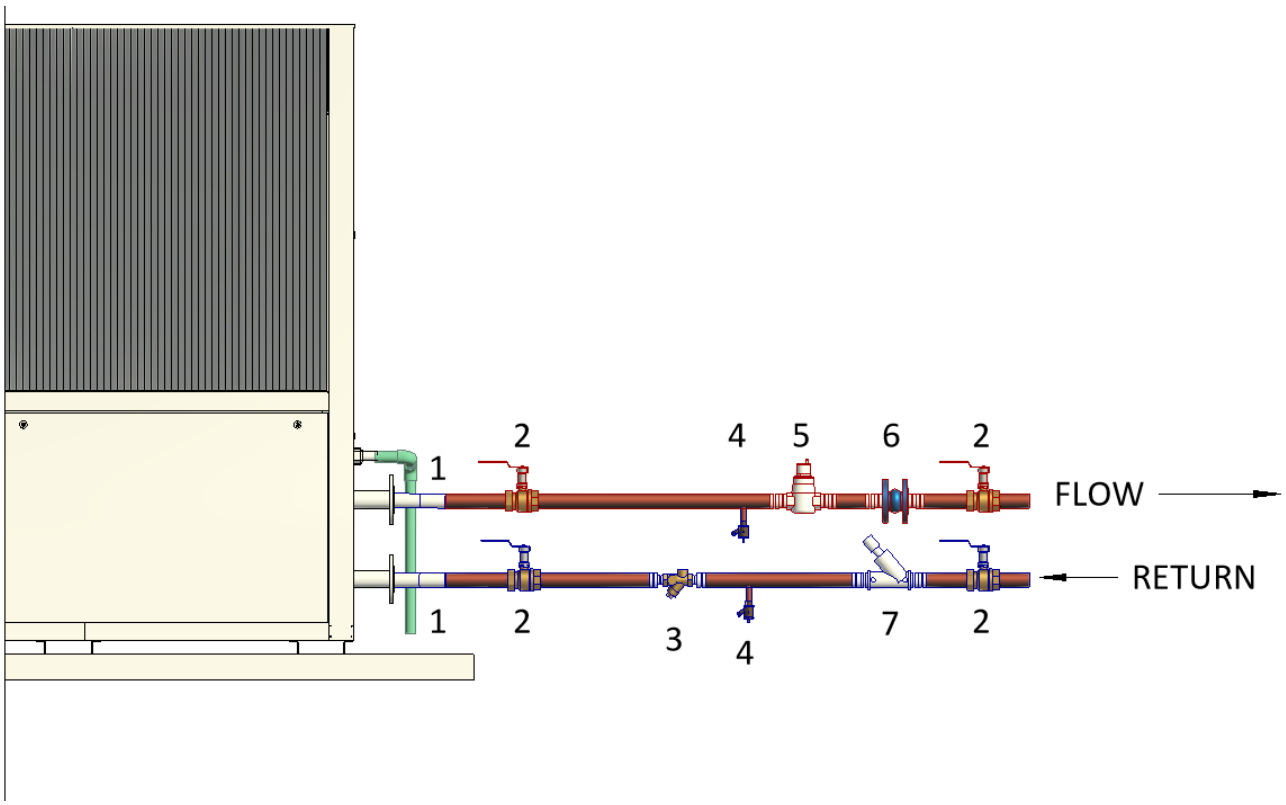


4.3.2 Elm 105/70 (SN + LN) kW

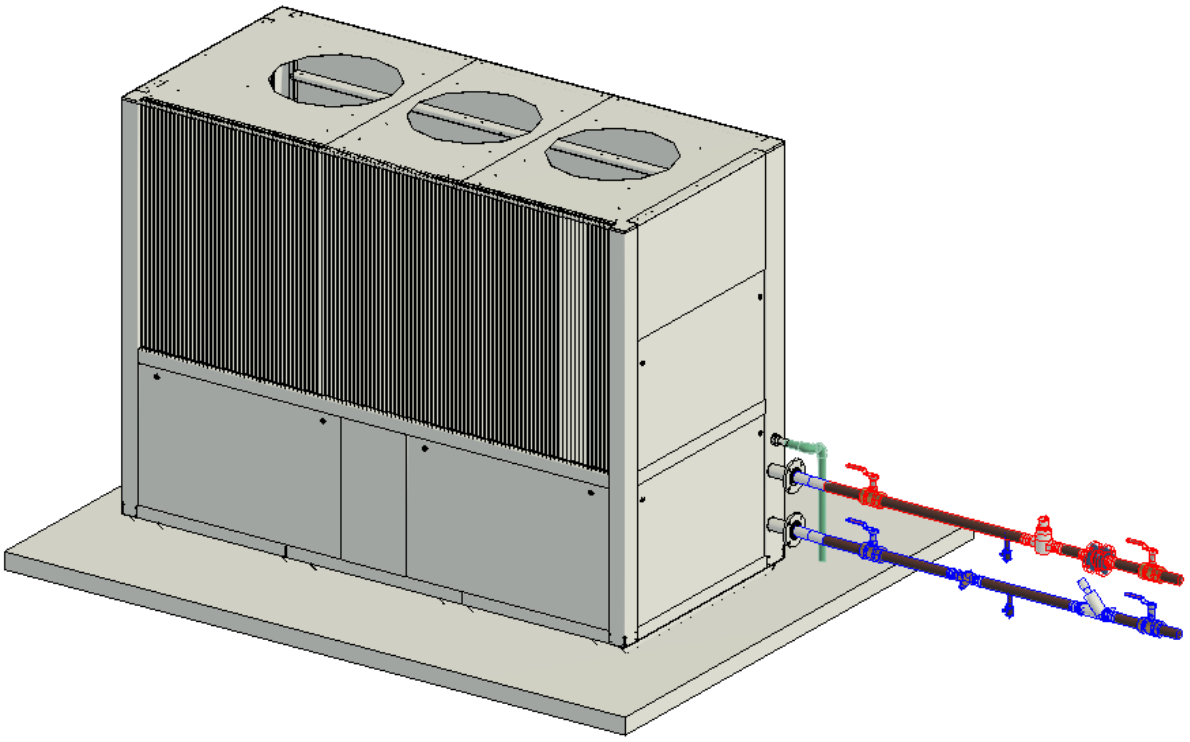


5 Piping and Hydraulics

5.1 Piping Connections



1	Flexible joint	Noise/vibration reduction
2	Isolation Valve	Allows for isolation and maintenance
3	Strainer	To remove debris from the system.
4	Drain valve	Allows for drainage during servicing of components
5	Air vent valve	Required to release air accumulating within system
6	Non-return valve	Prevents backflow, ensuring fluid moves in the intended direction.
7	Commissioning set	Used for system balancing, performance testing, and setting operational parameters during commissioning.



5.1.1 Pipe Connection Sizes

Connection Type	Elm 85/50kW	Elm 120/75kW
Heating Flow	54mm Copper - plain end	67mm Copper - plain end
Heating Return	54mm Copper - plain end	67mm Copper - plain end
Condensate	32mm solvent weld waste pipe - plain end	40mm solvent weld waste pipe - plain end

5.1.2 Frost Protection

In low ambient conditions the system designer must keep the primary circulation pump energised so that low-temperature hot water continues to pass through the plate heat exchangers. When the pump is running the pressure-independent control valve will open automatically and maintain the required flow.

Refer to Section 2.1.7 for additional freeze-protection measures that apply to any external pipework when pump power fails. Implementing these measures is also the responsibility of the system designer.

5.2 Defrost

The ASHPs come with their own hot gas frost protection cycle. This shuts off the internal LTHW flow through the ASHPs and directs hot gas through the evaporation coils removing any ice build-up. To mitigate the loss of output while in defrost, the system buffer vessel must be sized accordingly.

5.3 Minimum Free Flowing Water Content

In order to protect the integral components of the unit the Elm units require a minimum water content on the primary system side. These represent the minimum storage requirements necessary to protect the heat pump and allow for a maximum of six starts per hour.

	75/60kW	105/70kW
Water Volume	1400L	1679L

5.3.1 Optimal Buffer Sizing

While the minimum buffer sizes ensure basic heat pump protection and operational stability, optimally sized buffers enhance system efficiency, reduce cycling frequency, and improve overall performance. Buffer vessel sizing ultimately rests with the system designer however, the following recommendations provide guidance on selecting the ideal buffer capacity to maximise energy efficiency and maintain consistent heating output.

Defrost Cycle Management: Air source heat pumps undergo periodic defrost cycles, during which the heat pump uses hot gas to clear ice from the evaporator. During this period, the buffer vessel provides stored thermal energy to maintain heating supply to the building. The vessel must be sized to cover the full heat load during defrost to prevent temperature drops. Clade recommends a minimum of 30 minutes storage to cover this.

Peak Load Consideration: The buffer volume should accommodate the total peak kWh heating demand of the building while accounting for variations in heat pump output due to defrost.

Building Load Profiles: CIBSE Guide A shows how to perform detailed analysis of building heating load profiles. Factors such as occupancy patterns, thermal mass, and intermittent heating requirements should be evaluated to determine the total time the peak load is required and the necessary storage capacity.

5.3.2 Buffer Design Considerations

To ensure optimal performance and efficiency in heat pump systems, proper buffer vessel design is crucial. A well-designed buffer enhances stratification, maximises usable volume, and provides precise control for charging and discharging cycles. Key aspects of an effective buffer design include:

- Height-to-Width Ratio: A buffer vessel should have a minimum height-to-width ratio of 2.5:1. This geometry promotes better thermal stratification by reducing the potential for mixing between layers, ensuring a stable temperature gradient within the vessel.

- Sparge Pipes: Increases the useable volume of the vessel.

- External Combined Headers: One in one out header based on CIBSE Cp1. Prevents mixing and maintains stratification and is sized to achieve less than 0.3 m/s velocity into the vessel. The header helps maintain stable pressure conditions across both the primary and secondary circuits. This is essential for variable flow systems and avoids issues with fluctuating demand.

- Temperature sensors
    - Five temperature sensors distributed vertically within the buffer need to be distributed properly for precise monitoring and adjustments to maintain optimal conditions. When there are multiple buffers, these need to be spread across the vessels evenly.

5.4 System Pressure

All mechanical/LTHW systems require pressure relief equipment to maintain the safe working condition of the system. This will be designed and specified by the system designer/installer.

5.4.1 Degasser

A degasser is a specialised component installed in the heating system's pipework. In the rare event of a propane leak from the plate heat exchanger into the heating water circuit, the degasser helps mitigate the risk by Separating propane from water and then safely venting the gas.

As the contaminated water circulates through the degasser, the internal pressure drop and design features cause any dissolved propane to come out of solution and form gas bubbles. The separated propane gas is directed to a dedicated vent line that safely discharges it to the outside atmosphere. This prevents the gas from recirculating within the system or accumulating indoors, where it could pose a fire or health hazard.

For systems using propane refrigerant and a plate heat exchanger, it is strongly recommended to install a degasser with an appropriate gas separation and venting mechanism. Ensure the vent line is compliant with EN378 and terminates in a safe, well-ventilated outdoor location.

5.4.2 Safety Valves

Safety valves on the low-temperature hot-water side are compulsory on all Elm installations. Their role is to prevent system pressure from rising above the maximum allowable working pressure, thereby protecting pipework, heat exchangers and ancillary equipment from over-pressure incidents. It is the system designer's or installer's responsibility to select, size and install these valves in accordance with the national standards ensuring correct set pressure, sufficient discharge capacity and proper discharge piping.

6 Electrical Installation

6.1 Electrical data

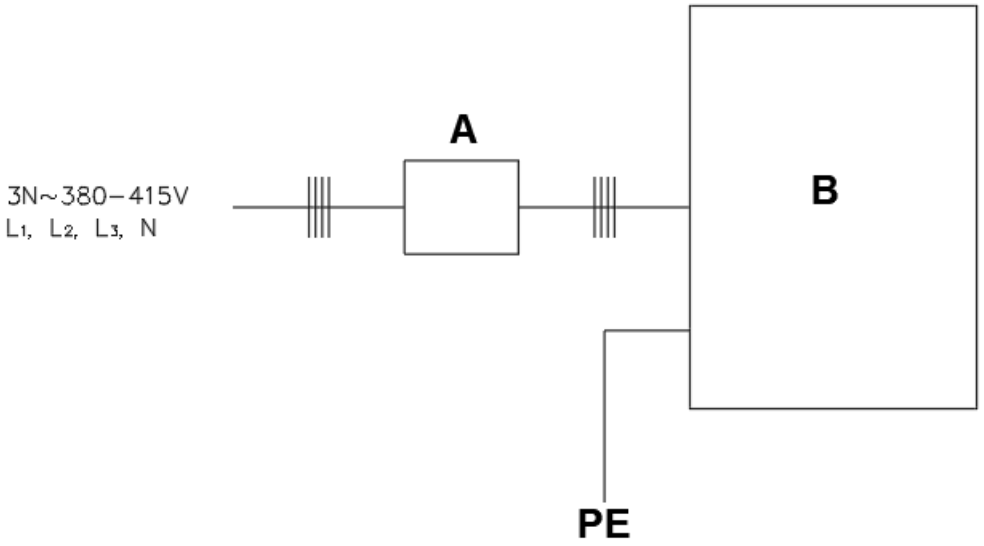
6.1.1 Supply voltage 400/3/50+N

Elm (SN + LN)		75/50kW	105/70kW
F.L.A. - Full load current at max admissible conditions (per phase)			
F.L.A. - Total	A	59.3	81.1
F.L.I. - Full load power input at max admissible conditions			
F.L.I. - Total	kW	36.3	47.7
M.I.C. - Maximum inrush current			
M.I.C. - Total	A	135.0	135.0

Power supply 400/3/50 (+ NEUTRAL) +/- 10%. Maximum Phase Unbalance: 2%.

For non-standard voltage please contact Clade technical office

6.2 Mains Supply Installation



A: Upstream Protection
B: ASHP

6.2.1 Power Supply Details

UNIT(SN + LN)	External power supply		
	Power supply	Switch manual	Fuses
75/50kW	380-415V 3N~ 50Hz	125A (pre mounted)	125A
105/70kW	380-415V 3N~ 50Hz	125A (pre mounted)	125A

Deviating connection lengths and electrical fuses must be calculated according to the country-specific regulations.

Each Elm ASHP requires a dedicated 400/3/50 +N power supply with tolerance ±10% and a maximum allowable phase imbalance of 2%.

- Each unit is supplied with its own local isolator and protection device.
- Upstream protection must be provided by the installer and correctly sized to suit the unit's full load and inrush currents (see Section 4.1).
- Cable sizing must consider local climatic conditions, service routes, ambient temperature, installation method, and grouping factors.
- The electrical installation must comply with BS 7671:2018 (IET Wiring Regulations) or the equivalent national wiring regulations in the country of installation.

⚠ CAUTION

- Always use correctly rated fuses or breakers. Incorrectly sized protective devices may result in malfunction, overheating, or fire.
- Ensure cables are adequately supported and that no external mechanical stress is imparted on terminations. Loose or stressed connections can cause overheating and arcing.

6.2.2 Maximum Cable Sizes

The maximum cable sizes into the isolators of the unit can be seen below.

Model (SN + LN)	Single or multiple strand wire (mm^2)	Fine strand with sleeve (mm^2)
Elm 75/50kW & 105/70kW	50	50

⚠ WARNING

Be sure to use specified wires and ensure no external force is imparted to terminal connections. Loose connections may cause overheating and fire.

⚠ CAUTION

Only use properly rated breakers and fuses. Using a protection device of the wrong size may cause the unit to malfunction or set fire.

6.3 Control Connections

Control cable specifications:

Remote controller cable size	0.3 - 1mm² 0.3 - 1mm² Shielded cable recommended to minimise electrical interference.
Cable between units	Cat 6

6.3.1 Terminal Block Arrangement

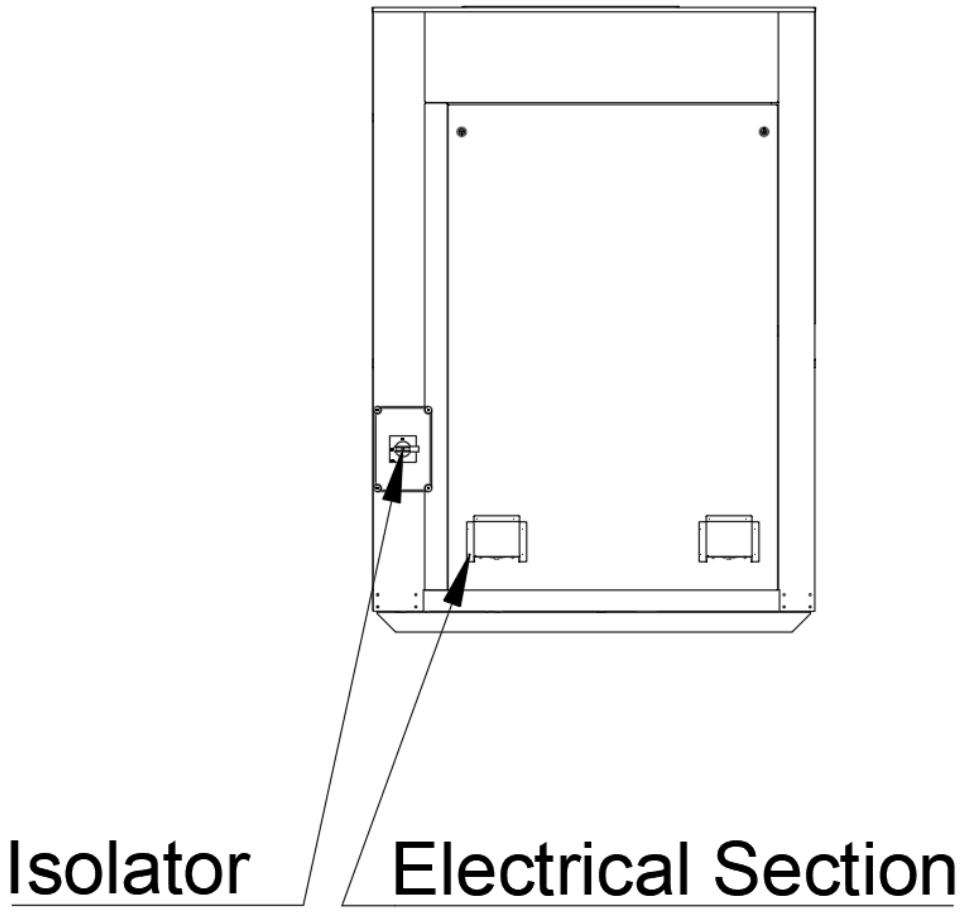
Remove front and side panels to gain access to the electrical controls and cable routes.

⚠ CAUTION

Earth tabs must be reconnected prior to refitting access panels

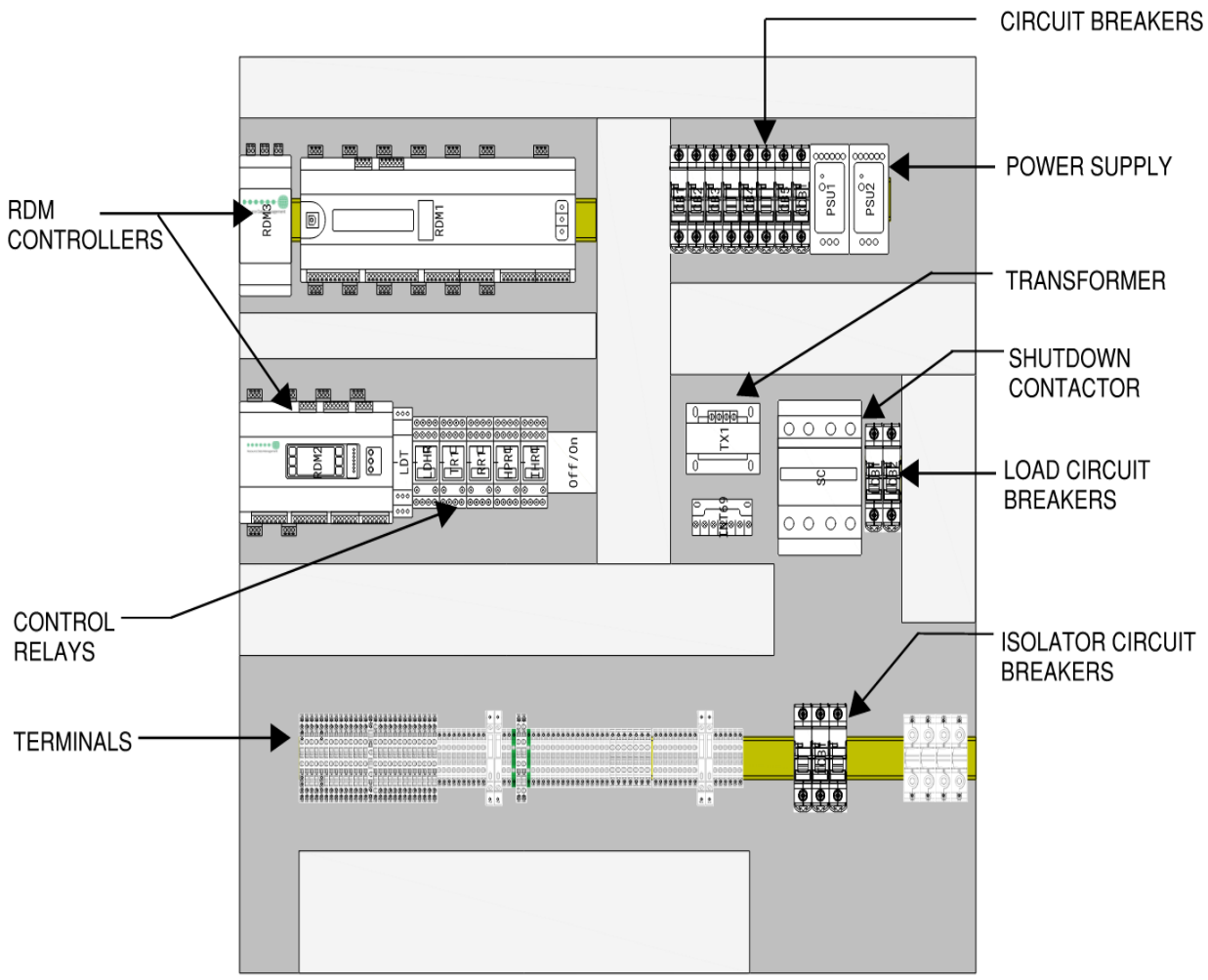
Cable glanding is located to the left-hand side of the unit where a rotary isolator is also provided for electrical connections. This can be seen in the image below. Stuffing glands located to the left-hand side of the unit shall be used for control cable access into the control panel.

- Size all supply cables in accordance with the full load current (FLA) of the unit (see Electrical Data section).
- Tighten all terminals to the torque values specified on the terminal-strip label.



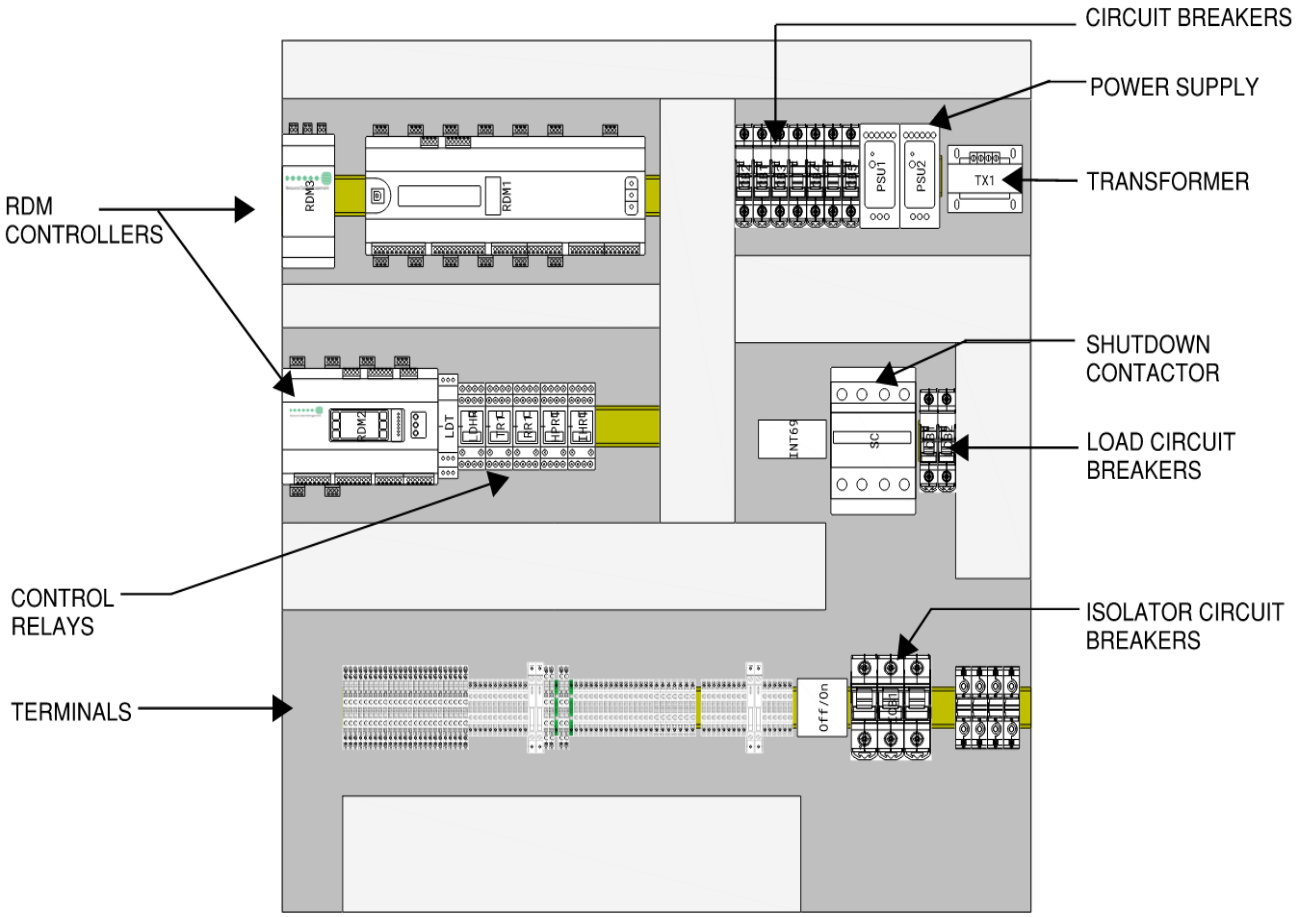
6.3.2 Elm 75/60kW Controls Layout

- Supply: 400V 3-Phase, 50Hz with 35mm terminals
- Main Circuit Breaker: ICB1 – 3-pole isolator circuit breaker
- Enclosure Size: 800w x 800h x 200d
- Control Voltage: 24 V AC (via TX1 transformer) and 24 V DC (via dual MEAN WELL PSU modules)
- Circuit Protection via MCBs (CB1-CB5), LCBs for fans, and CCB/ICB units for compressor isolation
- Relay Control: Includes RR1, TR1, IHR1, and HPR1 relays for run/stop, inverter feedback, and interlocks
- Shutdown Contactor (SC) for emergency stop and system safety loop compliance



6.3.3 Elm 70/105kW Controls Layout

- Supply: 400V 3-Phase, 50Hz with 35mm terminals
- Main Circuit Breaker: ICB1 – 3-pole isolator circuit breaker
- Enclosure Size: 800w x 800h x 200d
- Control Voltage: 24 V AC (via TX1 transformer) and 24 V DC (via dual MEAN WELL PSU modules)
- Circuit Protection via MCBs (CB1-CB5), LCBs for fans, and CCB/ICB units for compressor isolation
- Relay Control: Includes RR1, TR1, IHR1, and HPR1 relays for run/stop, inverter feedback, and interlocks
- Shutdown Contactor (SC) for emergency stop and system safety loop compliance



7 Controls

7.1 Individual Heat Pump Controls

Each heat pump is equipped with its own integrated, independent control system. It is designed to maintain a constant temperature differential (ΔT) between flow and return. The standard flow temperature can be set between 35 °C and 80 °C. Heating capacity and flow temperature are automatically regulated based on the return temperature, with ΔT set at 10K.

7.1.1 Off/On Switch

The Off/On switch selects the operation of the heat pump. Selecting the on position will start the heat pump. Selecting the Off position will instigate a stop sequence and stop the heat pump from running. The heat pump will continue to run for a short period until it has completed the stop sequence.

⚠ CAUTION

The Off/On switch should not be used in an emergency. Any emergency isolation should be carried out at the local isolator.
The inverter should be fully discharged, prior to removal of the compressor terminal box cover.

7.2 Control Type

There are three options for the method of control on the heat pump (multiplex, BMS & local control). These will be described in the following sections.

7.3 Multiplex Controls

7.3.1 Multiplex Control

Multiplex control should be used when the heat pump is to be controlled by a Clade Multi Heat Pump Controller. This enables the control of the heat pump by the Clade controller which can operate multiple heat pumps.

NOTE: Should the return water temperature go above 70°C, this will initiate a high return water fault and shut down the heat pump instantly.

The Clade controller generates a single demand signal (0–100%) and apportions it across the connected heat pumps to stage units in/out in line with instantaneous load.

Target A - Buffer energy state.

Multi-point sensing within the buffer vessel (typical probes T1–T5) is used to estimate the vessel's usable thermal charge. An internal weighting and normalisation routine produces a Buffer Charge Index. As the vessel approaches its calibrated "full" condition (accounting for stratification), the index tapers so that additional capacity is requested progressively less aggressively.

Target B - return protection.

The controller monitors either the common heat-pump return or the lowest vessel sensor (typically T5) against a protected maximum return limit. The deviation below this limit generates a Return Temperature Assist signal via a calibrated proportional slope with built in damping. This biases capacity upward when return water is comfortably below the limit, and backs capacity off as the limit is approached.

Blending of targets

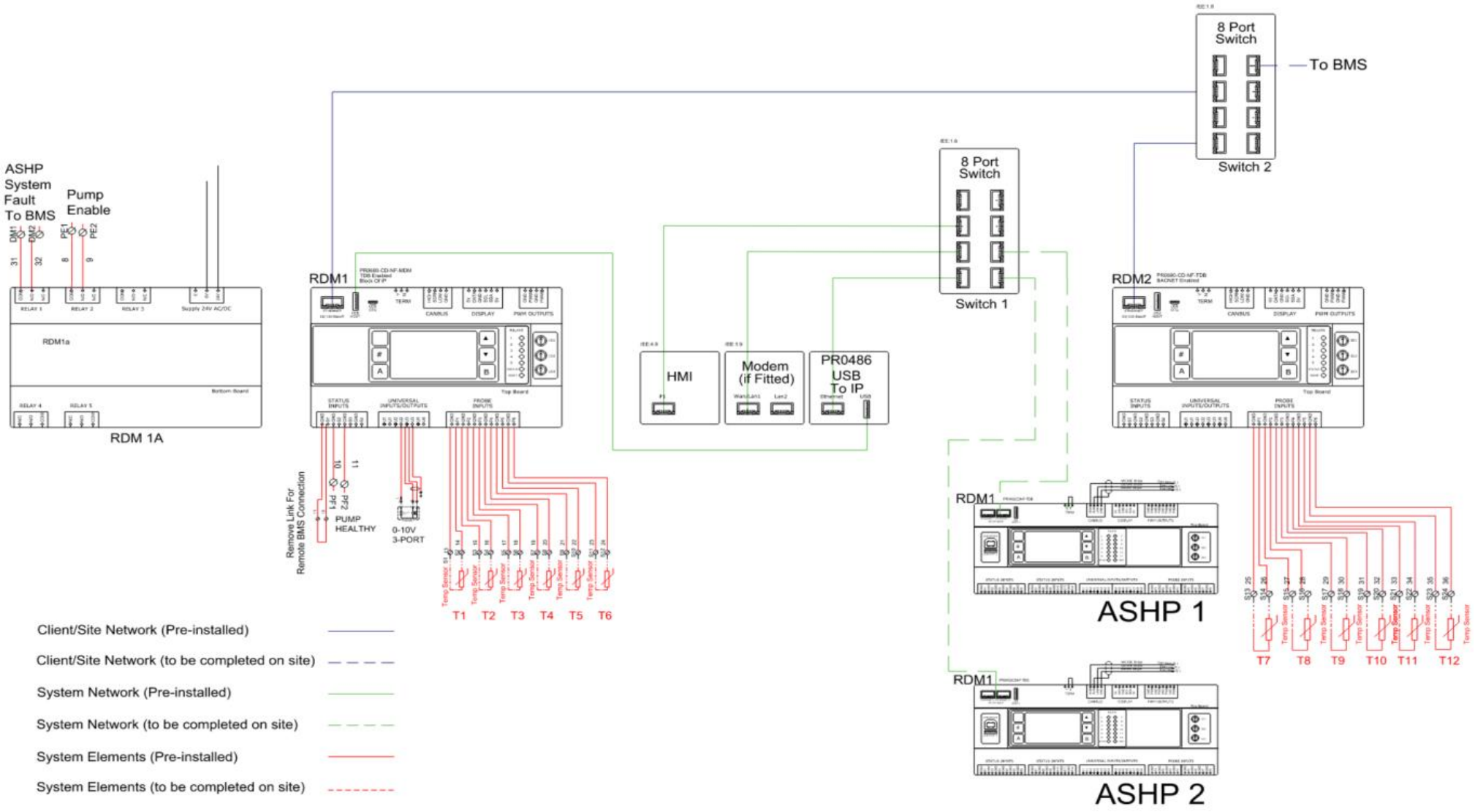
The demand signal is derived from a proprietary mapping that blends the Buffer Charge Index with the Return Temperature Assist. The resulting demand (0–100%) is divided across the available heat pumps to determine staging increments for each unit.

The strategy maintains a slight bias toward higher flow on the heat pump circuit so that hotter supply water is continuously pulled through the buffer and blended with the system return. This steadily raises the vessel's usable charge while keeping source-side returns within the safe operating envelope. If the monitored return approaches the protected limit, capacity is progressively reduced, and may be suspended, to prevent sending excessively hot water back to the heat pumps.

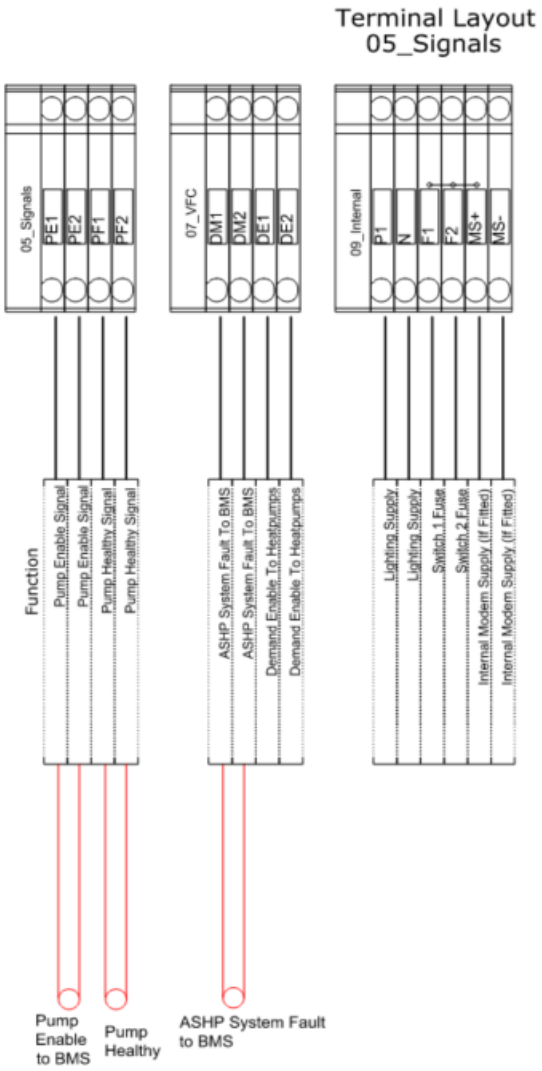
An optional, selectable weather compensation function is available within the controller. By progressively lowering the flow temperature in response to higher outdoor temperatures, this mode optimises seasonal efficiency and delivers higher coefficients of performance.

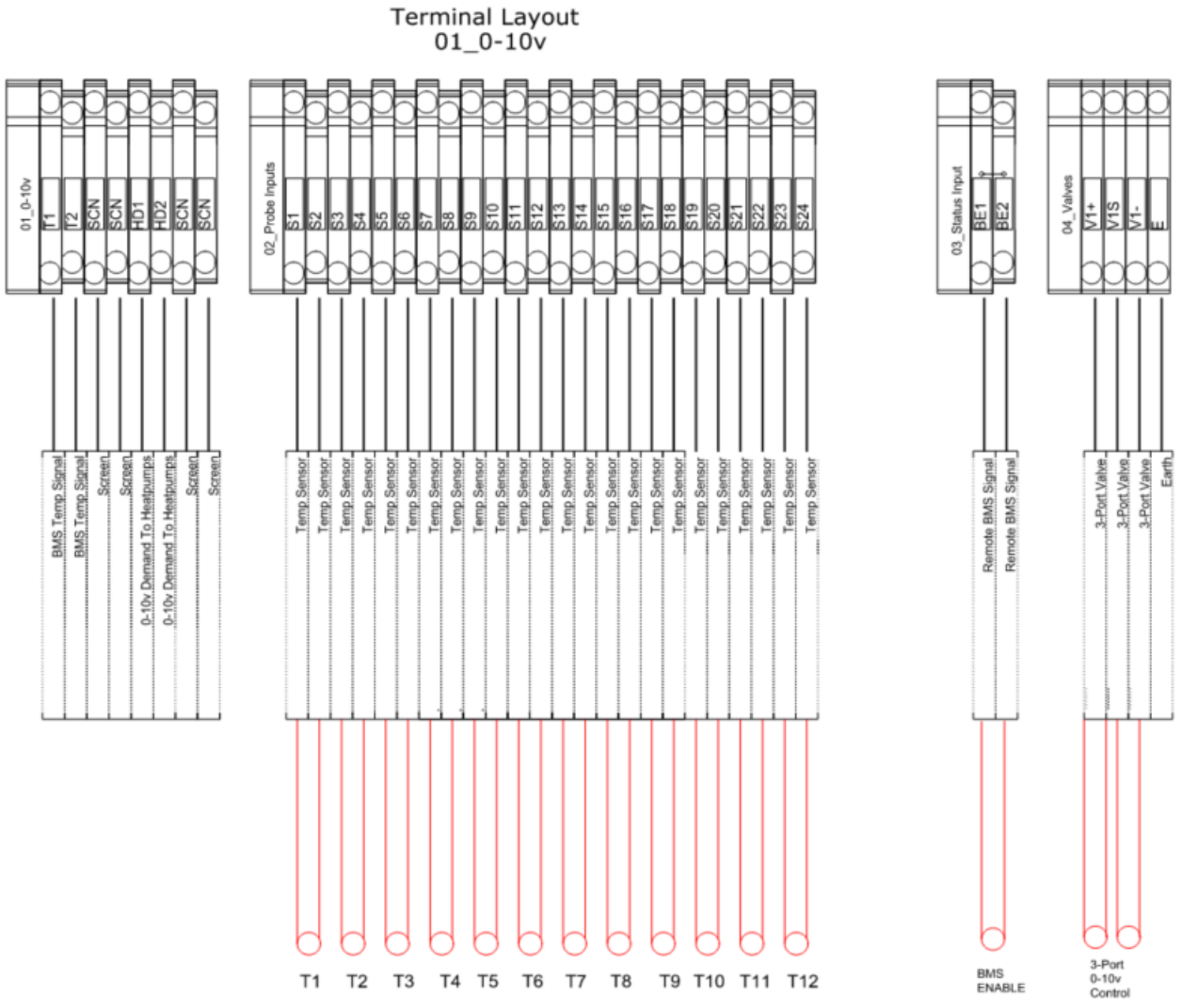
Clade Multi Heat Pump Controller will be installed as a standalone unit. The heat pumps will connect to the Clade controller by CAT6 cable between the two units, installed by the contractor as below.

Clade Multi Heat Pump Controller



Terminal Layout





7.3.2 Heat Pump Data

A single connection to the Clade controller is all that is required to access all connected heat pump data. If the client wishes to monitor or log this data via their Building Management System, the controller can be integrated through its BACnet interface. The table below details the data points available via the BACnet connection from the Clade controller:

Clade Multi Heat Pump Controller (large)				
Device Name		**BACnet**		
Inst.-No.		**280028**		
Obj. Type	**Object Name**	**Description**	**Unit**	**Read/Write**
BO	obj_1	System Healthy	On=Healthy / Off=Fault	Read
AO	obj_2	Ambient Temp	°C	Read
AO	obj_3	ASHP Target Temp	°C	Read
AO	obj_4	Heating Demand	%	Read
AO	obj_5	T1 Temp	°C	Read
AO	obj_6	T2 Temp	°C	Read
AO	obj_7	T3 Temp	°C	Read
AO	obj_8	T4 Temp	°C	Read
AO	obj_9	T5 Temp	°C	Read
AO	obj_10	T6 Temp	°C	Read
AO	obj_11	T7 Temp	°C	Read
AO	obj_12	T8 Temp	°C	Read
AO	obj_13	T9 Temp	°C	Read
AO	obj_14	T10 Temp	°C	Read
AO	obj_15	T11 Temp	°C	Read
AO	obj_16	T12 Temp	°C	Read
AO	obj_17	HP1 Status	*See Status Table	Read
AO	obj_18	HP1 P11 Flow Temp	°C	Read
AO	obj_19	HP1 P12 Return Temp	°C	Read
AO	obj_20	HP2 Status	*See Status Table	Read
AO	obj_21	HP2 P11 Flow Temp	°C	Read
AO	obj_22	HP2 P12 Return Temp	°C	Read
AO	obj_23	HP3 Status	*See Status Table	Read
AO	obj_24	HP3 P11 Flow Temp	°C	Read
AO	obj_25	HP3 P12 Return Temp	°C	Read
AO	obj_26	HP4 Status	*See Status Table	Read
AO	obj_27	HP4 P11 Flow Temp	°C	Read
AO	obj_28	HP4 P12 Return Temp	°C	Read
AO	obj_29	HP5 Status	*See Status Table	Read
AO	obj_30	HP5 P11 Flow Temp	°C	Read
AO	obj_31	HP5 P12 Return Temp	°C	Read
AO	obj_32	HP6 Status	*See Status Table	Read
AO	obj_33	HP6 P11 Flow Temp	°C	Read
AO	obj_34	HP6 P12 Return Temp	°C	Read
AO	obj_35	HP7 Status	*See Status Table	Read
AO	obj_36	HP7 P11 Flow Temp	°C	Read
AO	obj_37	HP7 P12 Return Temp	°C	Read
AO	obj_38	HP8 Status	*See Status Table	Read
AO	obj_39	HP8 P11 Flow Temp	°C	Read
AO	obj_40	HP8 P12 Return Temp	°C	Read
***Status Table**				
0=Off				
1=Heating				
2=Defrost				
3=Satisfied				
4=Initialising				
5=Fault				
6=Not Present				
7=Offline				

7.4 BMS Control

This control type must be selected when it is intended to control the heat pump from an independent BMS.

Selecting BMS will allow the heat pump to operate on a 0-10V input signal from the BMS, overriding the local return temperature control.

A 0-10V signal allows the heat pump to be controlled to a desired capacity (QH) based on a percentage of maximum capacity.

NOTE: Maximum capacity will alter dependent on ambient temperatures. Therefore, the minimum QH at 2V (50%) at -5ºC will be less than the minimum capacity during times of warmer ambient conditions. When sizing and selecting buffer vessels the low demands of the building need to be considered in conjunction with minimum turn capacity of the heat pump. Published capacities at 7ºC ambient temperatures are deemed as maximum capacities.

The table below denotes the controls associated with a 0-10V signal:

Voltage Signal	Status
0-0.9	Fault
1-1.9	Off
2	Capacity Control (50-100%)
3	
4	
5	
6	
7	
8	
9	
10	

NOTE: The function will not be available when operating as a multiplex installation using the Clade controller

7.5 Local control

Selecting LOCAL control means the heat pump will control without any external control signals. This should be selected when there is no BMS 0-10V capacity control input or Calde Controller input. Selecting this control type means the unit will operate on return temperature control.

Flow Temperature and Return Temperature Control

When the return water temperature rises into the designated delta-temperature (ΔT) range, the heat pump automatically reduces its heat output. This reduction lowers the pump's flow rate while still maintaining the desired flow temperature. Conversely, if the return water temperature drops, the heat pump's heating capacity increases, thereby increasing the flow rate to maintain a constant flow temperature.

High Return Water Condition

If the return water temperature increases further—resulting in a temperature difference that is less than 3K (i.e., ΔT – 3K relative to the flow temperature)—the system will trigger a high return water stop condition. In this state, the heat pump switches to a 'Satisfied' status, indicating that the required heating has been met. The heat pump will resume its normal 'Heating' mode once the return water temperature drops enough so that the temperature difference exceeds the reactivation threshold of ΔT +2K.

7.6 Controller IO

7.6.1 Elm 75/60 kW and 105/70 kW Controller IO

PR0652 CD NF TDB		
Status Inputs	**Location**	**ID**
Compressor Healthy	S1	
Evaporator 1 Fan Healthy	S2	
Evaporator 2 Fan Healthy	S3	
Evaporator 3 Fan Healthy	S4	
Heating Pump Healthy	S5	
System On / Off (Backplate Switch)	S6	
BMS Enable	S7	
Spare	S8	
Spare	S9	
Spare	S10	
Spare	S11	
Spare	S12	
Relay Outputs	**Location**	**ID**
Compressor Enable	Relay 1	
Heating Pump Enable	Relay 2	
System Healthy	Relay 3	
Spare	Relay 4	
Spare	Relay 5	
Spare	Relay 6	
Spare	Relay 7	
Spare	Relay 8	
Spare	Relay 9	
Universal Inputs/Outputs	**Location**	**ID**
Suction Pressure (0-160Bar) (4-20mA)	U1	TR1
Discharge Pressure (0-160Bar) (4-20mA)	U2	TR2
Compressor VSD Level (0-10v)	U3	
Heating Pump Level (0-10v)	U4	
Evaporator Fans Level (0-10v)	U5	
Spare	U6	
Flow Meter (4-20mA)	U7	
Capacity Demand (0-10v)	U8	
Probe Inputs	**Location**	**ID**
Ambient Temperature	P1	P1
Suction Temperature	P2	P2
Discharge Temperature	P3	P3
PHX Liquid Outlet Temperature	P4	P5
Heating Flow Temperature	P5	P11
Heating Return Temperature	P6	P12
Evaporator Circuit Outlet Temperature	P7	P14-1
Evaporator Circuit Inlet Temperature	P8	P15-1
Stepper Outputs	**Location**	**ID**
Evaporator Expansion Valve	Stepper 1	STV1
Defrost Regulation Valve	Stepper 2	STV2

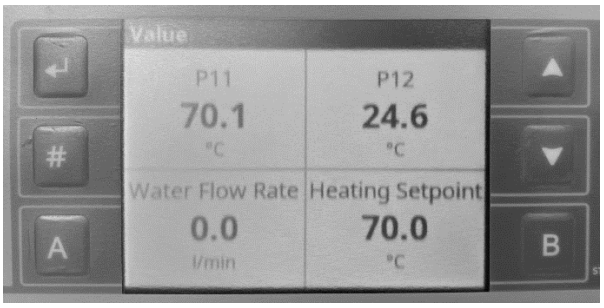
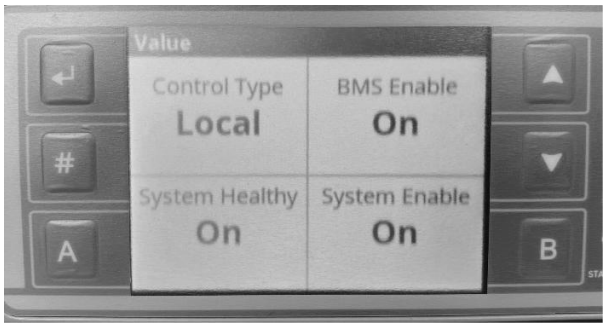
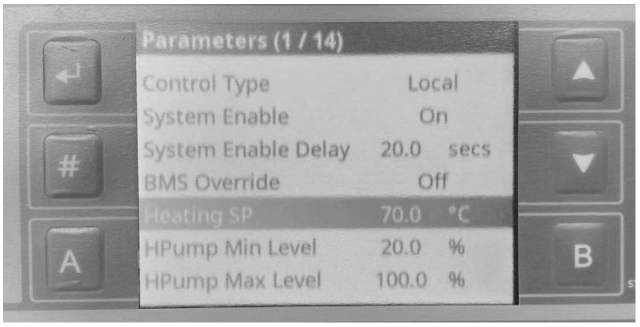
8 First Time Set Up

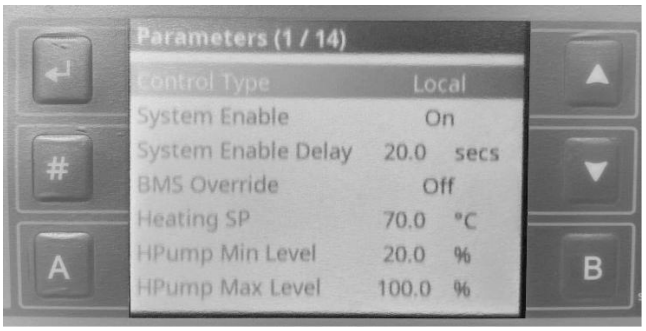
Before switching on the heat pump for the first time ensure that the LTHW circuit is filled with water and all air is removed from the system and the door switch is set to off.

The heat pump will operate according to the control type selected so on first start up it is important the desired control type is selected on the heat pump controller. See Controls section of this document for information on types of control for the heat pump.

8.1 Selecting Control Type

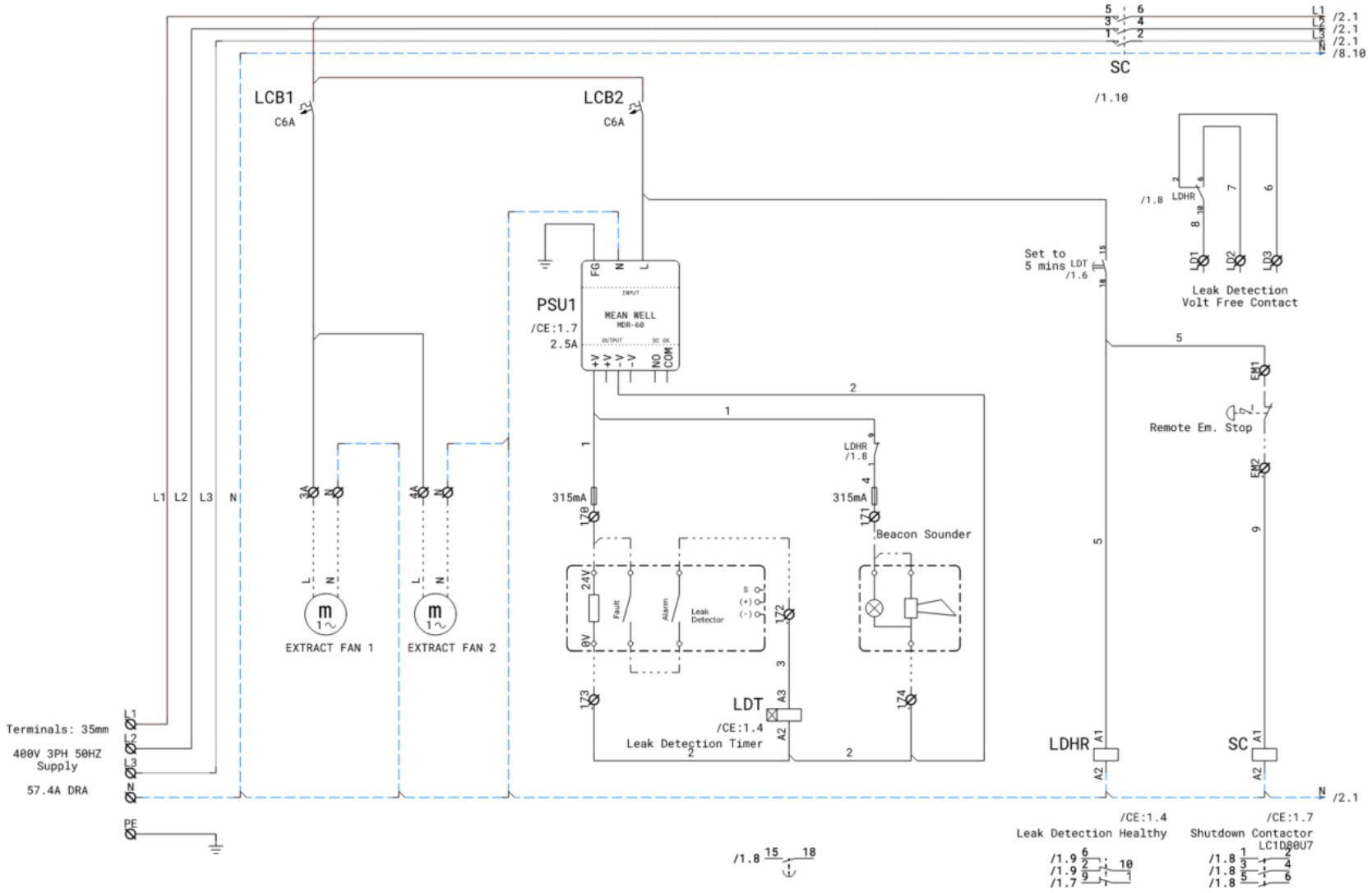
Before the unit will operate, the control type must be selected. To select the control type on the controller:

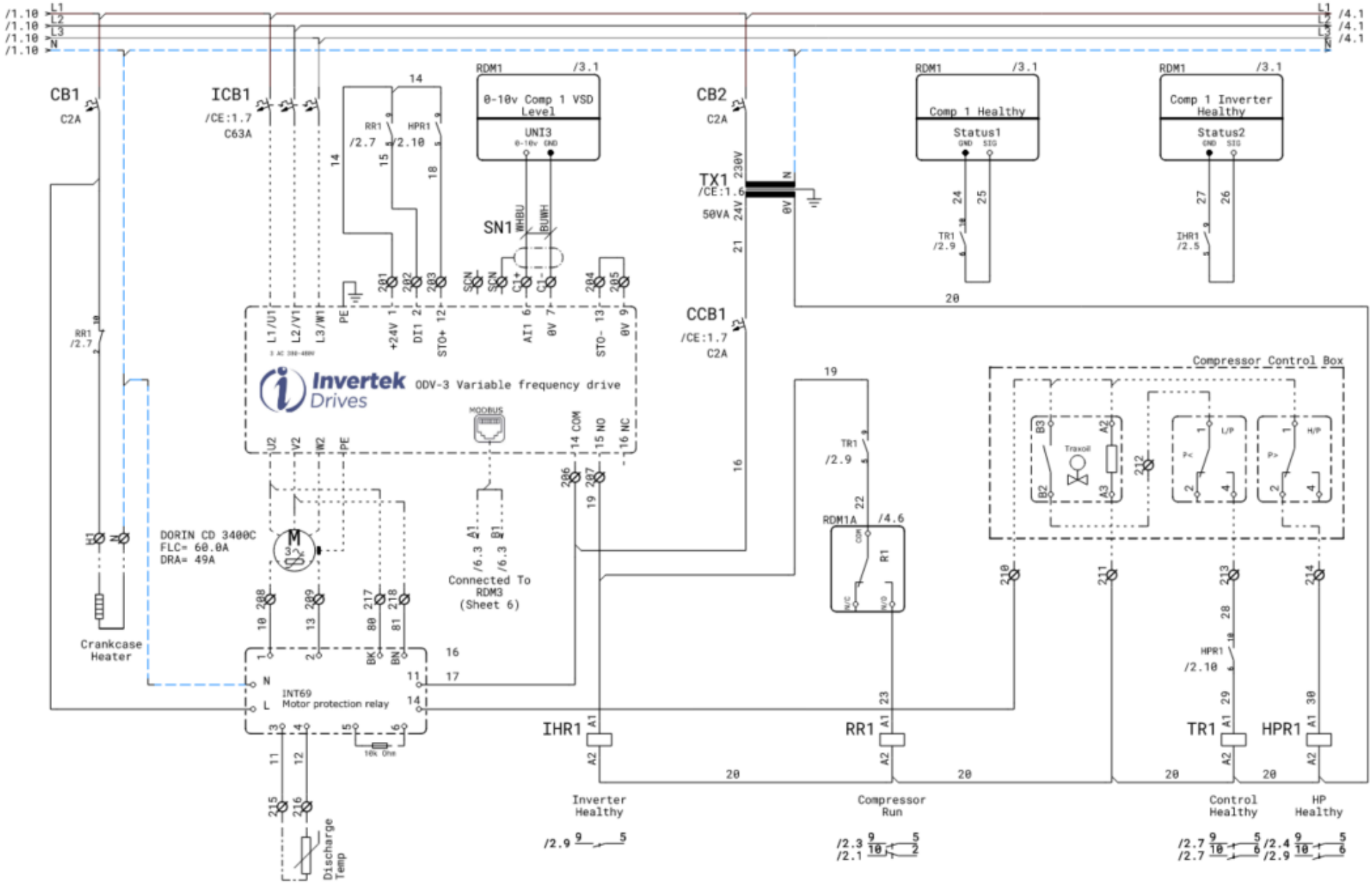
Press the ENTER key to enable the RDM screen:	
Press the B key and check control type:	
To change the control type, press ENTER and DOWN keys simultaneously to access the menu:	

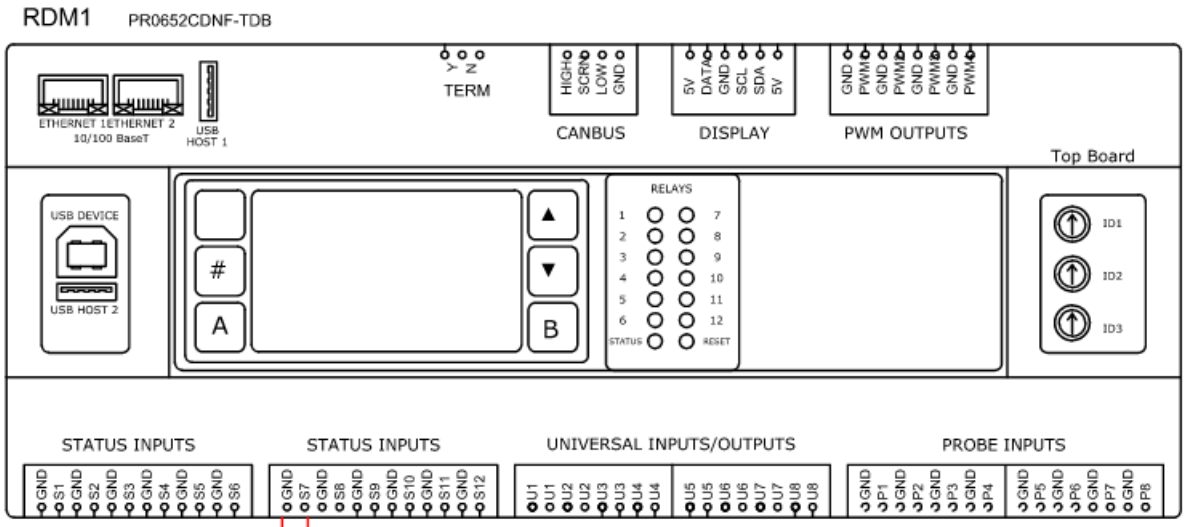
Press the B key to scroll through the parameter menu: Press the DOWN key to parameter page listing Control Type parameter:	
Press ENTER, then using UP/DOWN keys, scroll through to the correct control type. Press ENTER key to select type:	
Press the # key to return to the front screen.	

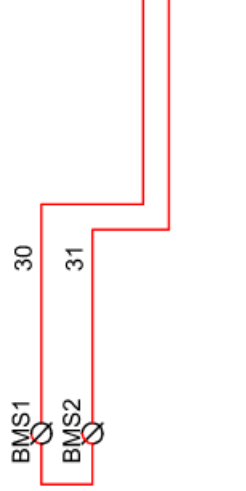
9 Wiring Diagrams

9.1 Elm 75/60kW Power Wiring



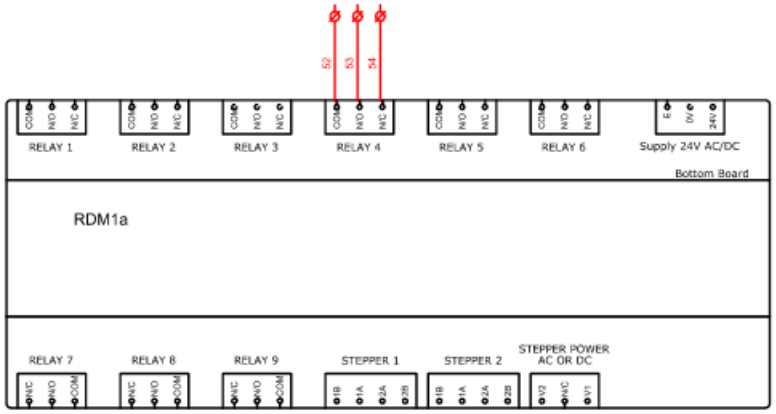

CB1
C2A
ICB1
/CE:1.7
C63A
CB2
C2A
TX1
/CE:1.6
50VA
CCB1
/CE:1.7
C2A
RDM1 /3.1
0-10v Comp 1 VSD Level
UNI3
RDM1 /3.1
Comp 1 Healthy
Status1
RDM1 /3.1
Comp 1 Inverter Healthy
Status2
SN1
Invertek Drives
ODV-3 Variable frequency drive
MODBUS
DORIN CD 3400C
FLC= 60.0A
DRA= 49A
Crankcase Heater
Connected To RDM3 (Sheet 6)
INT69
Motor protection relay
Discharge Temp
RDM1A /4.6
Compressor Control Box
Traxoil
IHR1
RR1
TR1
HPR1
Inverter Healthy
Compressor Run
Control Healthy
HP Healthy

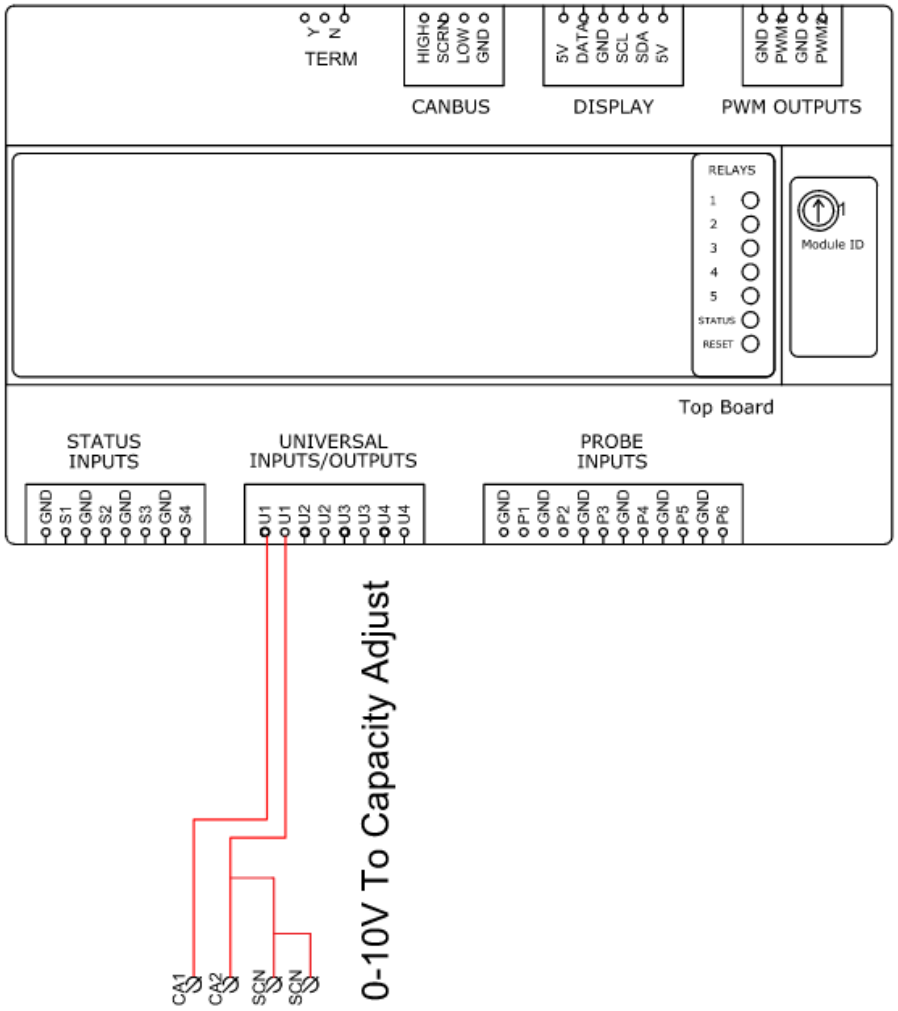


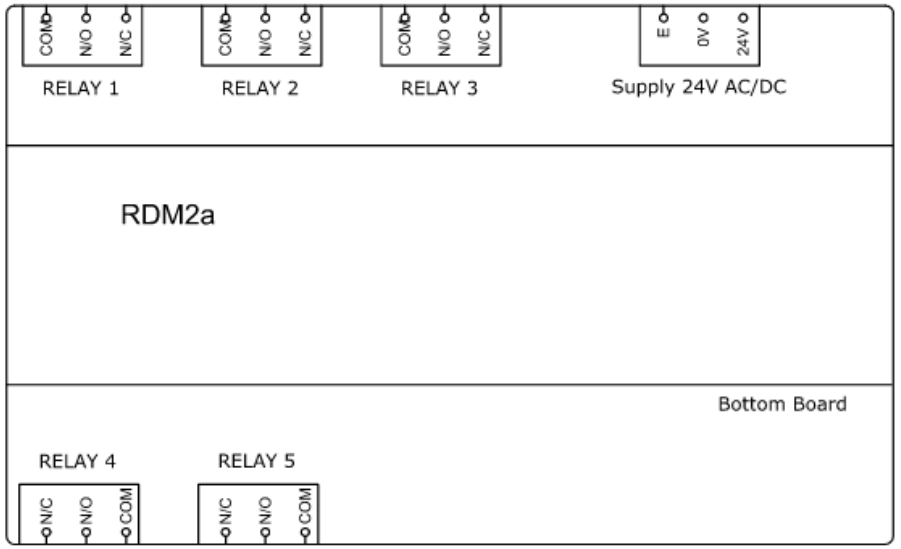


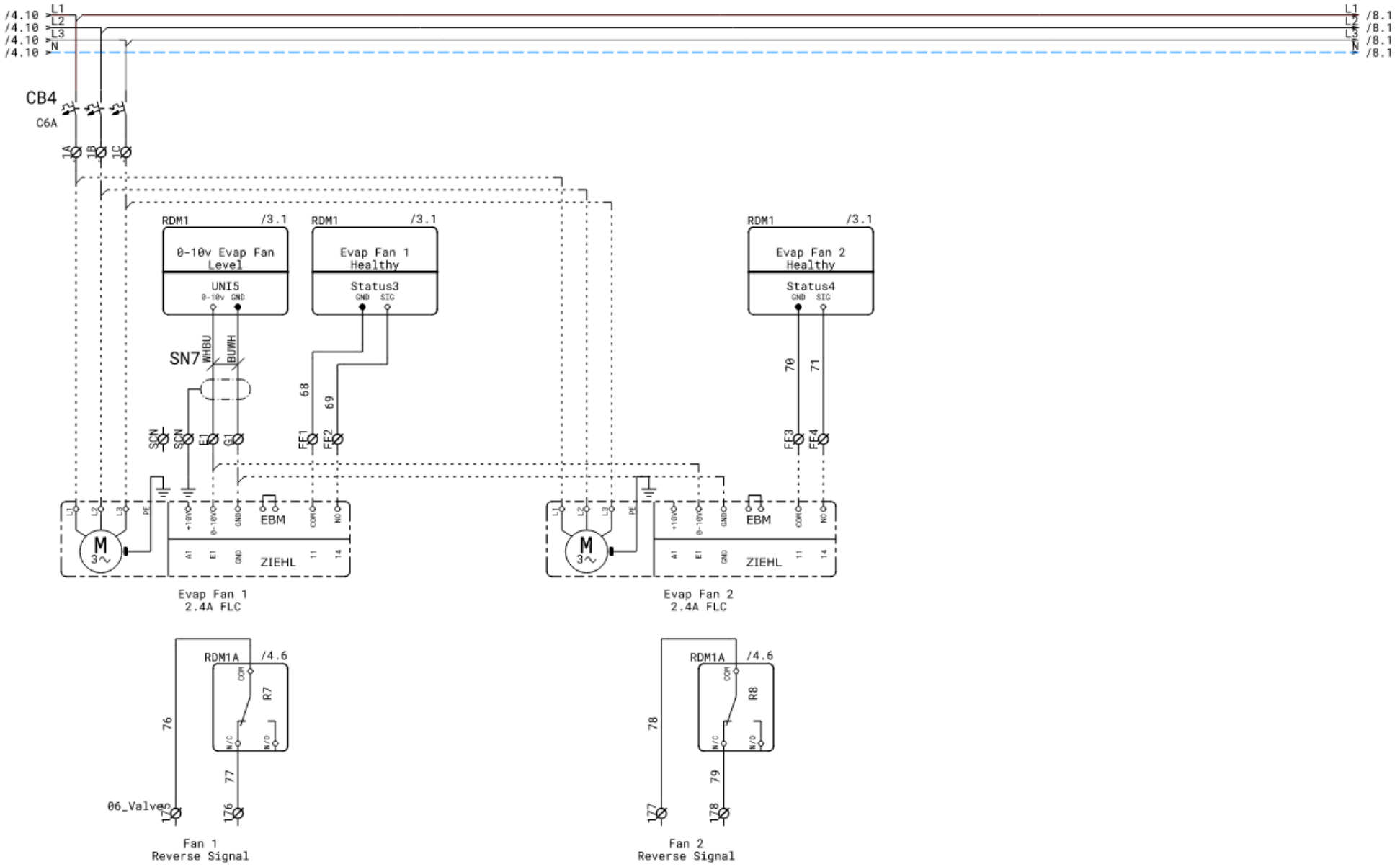
Remove Link
For Remote
BMS Connection

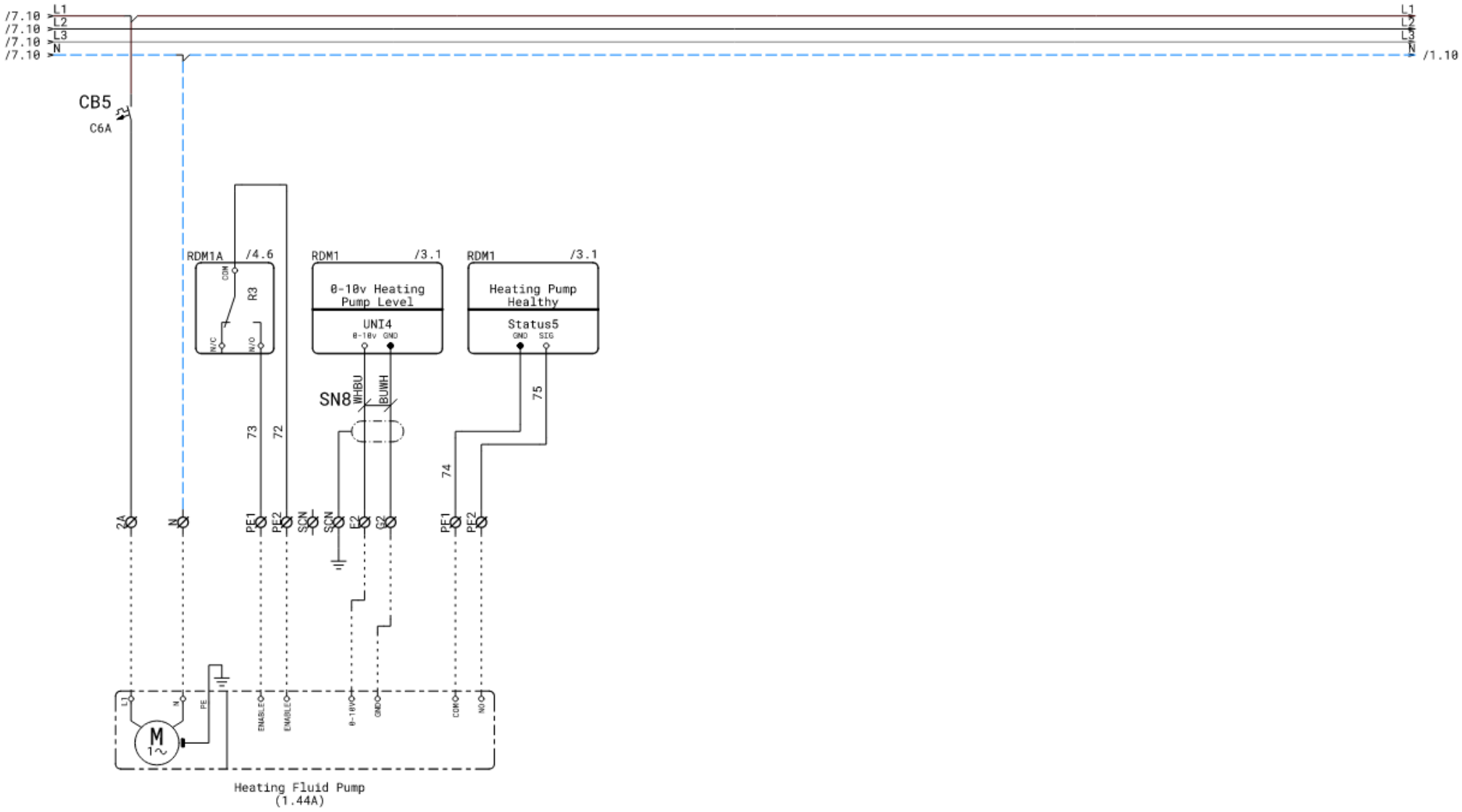
System
Healthy



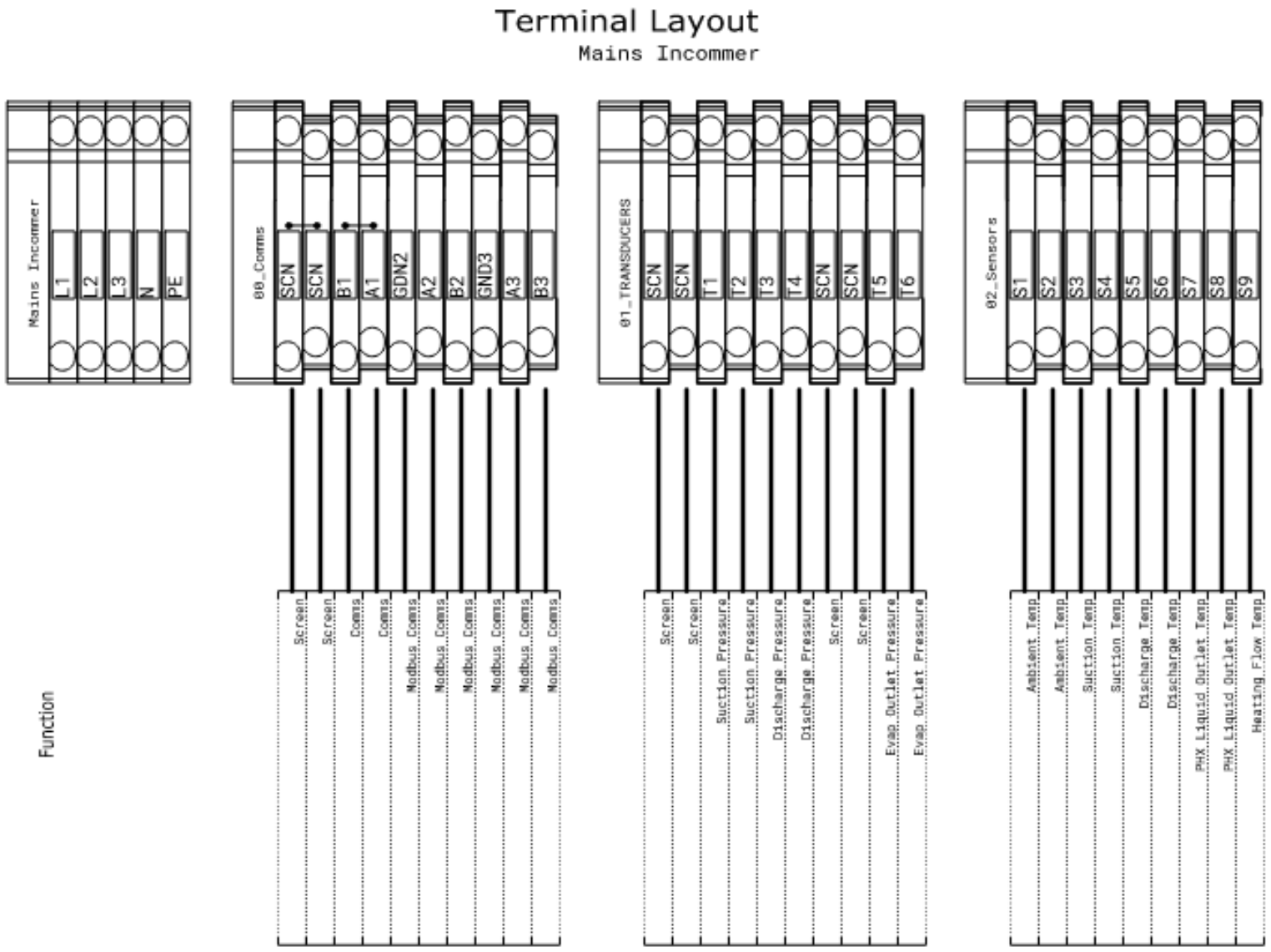

Y
N
TERM
HIGH
SCRN
LOW
GND
CANBUS
5V
DATA
GND
SCL
SDA
5V
DISPLAY
GND
PWM
GND
PWM
PWM OUTPUTS
RELAYS
1
2
3
4
5
STATUS
RESET
Module ID
Top Board
STATUS INPUTS
GND
S1
GND
S2
GND
S3
GND
S4
UNIVERSAL INPUTS/OUTPUTS
U1
U1
U2
U2
U3
U3
U4
U4
PROBE INPUTS
GND
P1
GND
P2
GND
P3
GND
P4
GND
P5
GND
P6
CA1
CA2
SCN
SCN
0-10V To Capacity Adjust

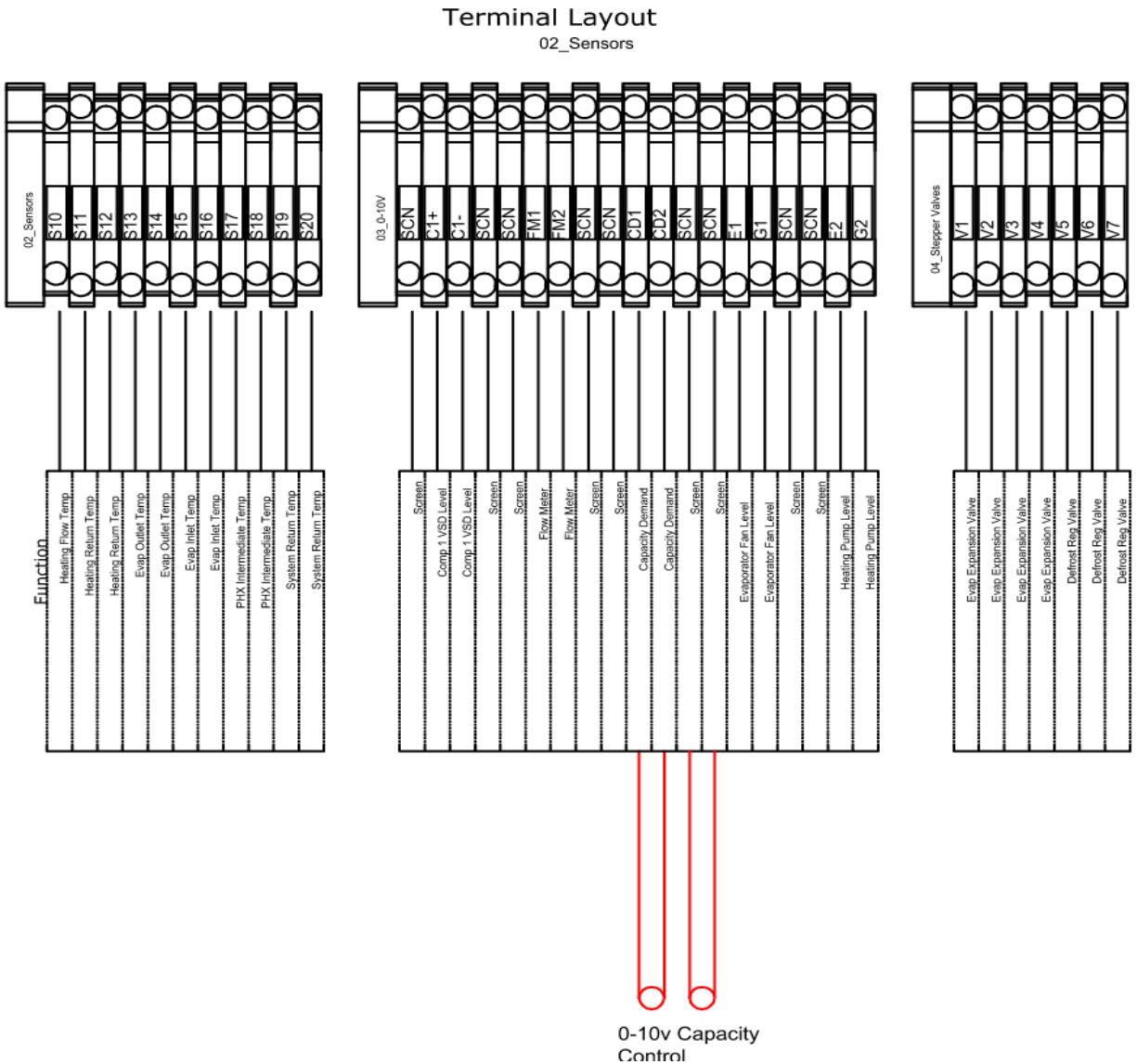

COM
N/O
N/C
RELAY 1
COM
N/O
N/C
RELAY 2
COM
N/O
N/C
RELAY 3
E
0V
24V
Supply 24V AC/DC
RDM2a
Bottom Board
RELAY 4
N/C
N/O
COM
RELAY 5
N/C
N/O
COM


/4.10 L1
/4.10 L2
/4.10 L3
/4.10 N
L1 /8.1
L2 /8.1
L3 /8.1
N /8.1
CB4
C6A
RDM1 /3.1
0-10v Evap Fan Level
UNI5
0-10v GND
RDM1 /3.1
Evap Fan 1 Healthy
Status3
GND SIG
RDM1 /3.1
Evap Fan 2 Healthy
Status4
GND SIG
SN7
WHBU
BUWH
SCN
SCN
G1
68
69
FE1
FE2
70
71
FE3
FE4
EBM
ZIEHL
Evap Fan 1
2.4A FLC
Evap Fan 2
2.4A FLC
RDM1A /4.6
R7
R8
76
77
78
79
06_Valves
175
176
177
178
Fan 1
Reverse Signal
Fan 2
Reverse Signal


/7.10 L1
/7.10 L2
/7.10 L3
/7.10 N
L1
L2
L3
N
/1.10
CB5
C6A
RDM1A /4.6
COM
R3
N/C
N/O
RDM1 /3.1
0-10v Heating Pump Level
UNI4
0-10v GND
RDM1 /3.1
Heating Pump Healthy
Status5
GND SIG
SN8
WHBU
BUWH
73
72
74
75
2A
N
PE1
PE2
SCN
SCN
G2
G2
PE1
PE2
L1
N
PE
M
ENABLE
ENABLE
0-10VG
GND
COM
NO
Heating Fluid Pump
(1.44A)

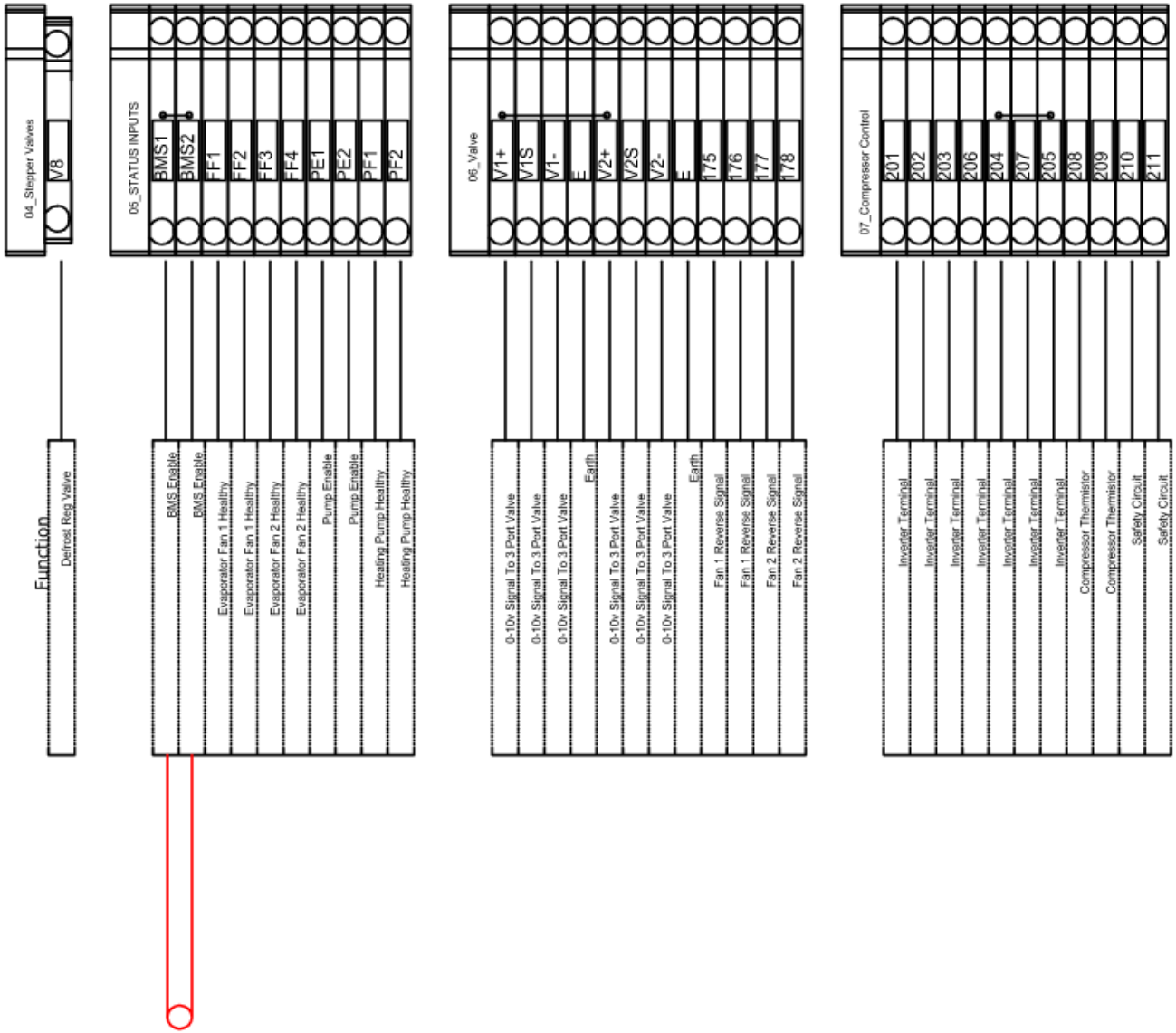
Terminal Layout




Terminal Layout
02_Sensors
02_Sensors
S10
S11
S12
S13
S14
S15
S16
S17
S18
S19
S20
03_0-10V
SCN
C1+
C1-
SCN
SCN
FM1
FM2
SCN
SCN
CD1
CD2
SCN
SCN
E1
G1
SCN
SCN
E2
G2
04_Stepper Valves
V1
V2
V3
V4
V5
V6
V7
Function
Heating Flow Temp
Heating Return Temp
Heating Return Temp
Evap Outlet Temp
Evap Outlet Temp
Evap Inlet Temp
Evap Inlet Temp
PHX Intermediate Temp
PHX Intermediate Temp
System Return Temp
System Return Temp
Screen
Screen
Comp 1 VSD Level
Comp 1 VSD Level
Screen
Screen
Flow Meter
Flow Meter
Screen
Screen
Capacity Demand
Capacity Demand
Screen
Screen
Evaporator Fan Level
Evaporator Fan Level
Screen
Screen
Heating Pump Level
Heating Pump Level
Evap Expansion Valve
Evap Expansion Valve
Evap Expansion Valve
Evap Expansion Valve
Defrost Reg Valve
Defrost Reg Valve
Defrost Reg Valve
0-10v Capacity
Control

Terminal Layout

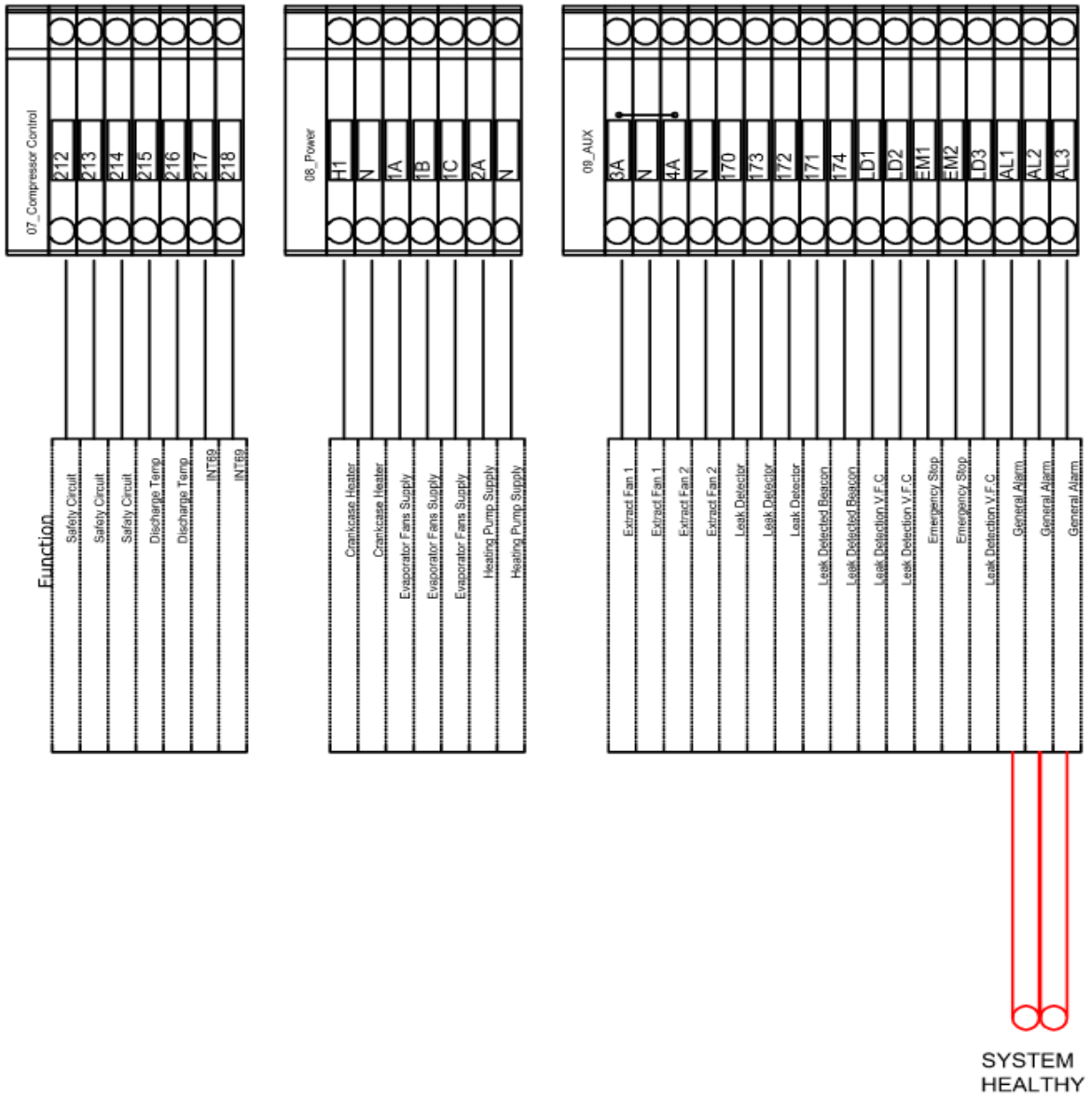
04_Stepper Valves



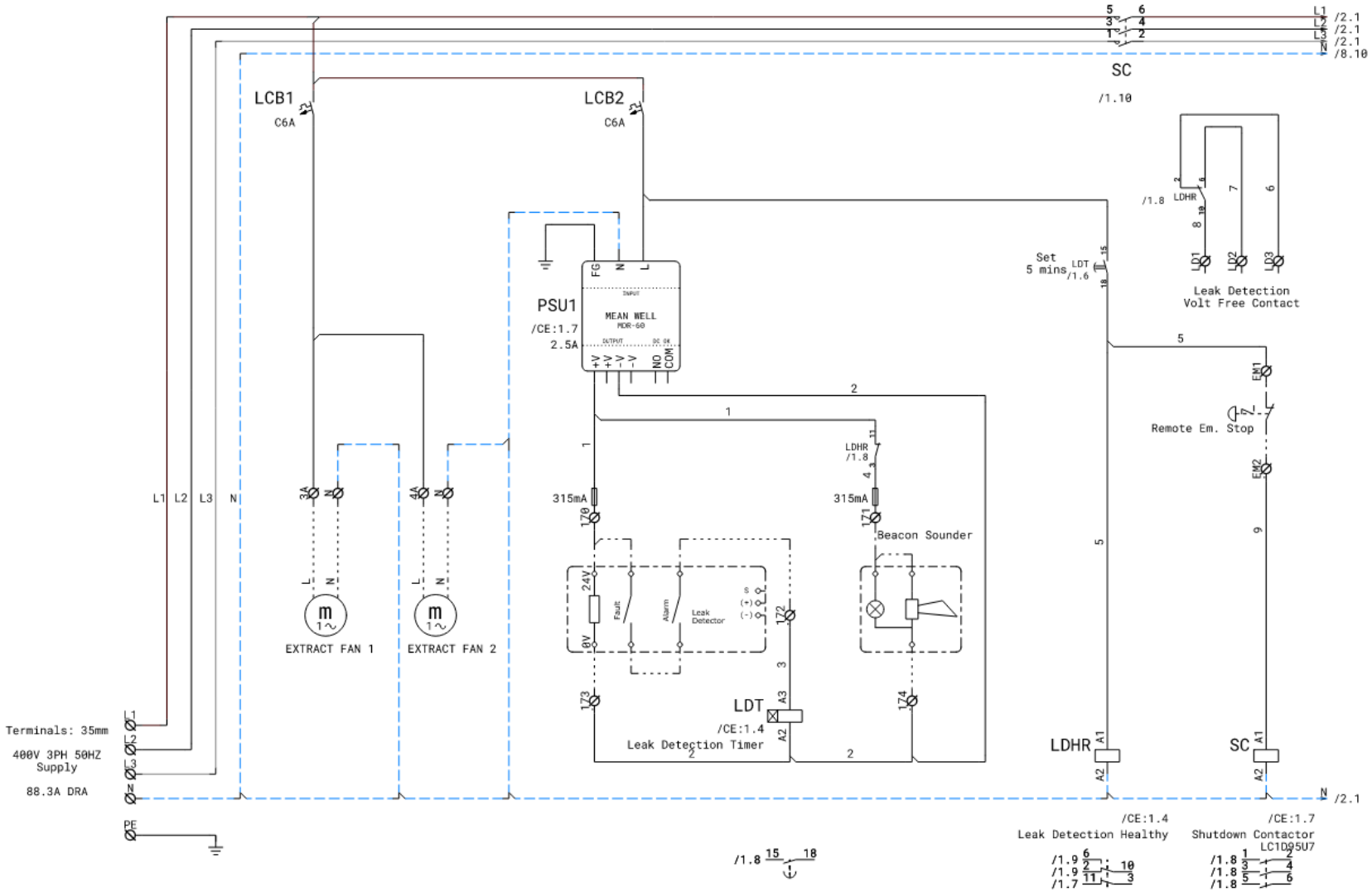
BMS ENABLE

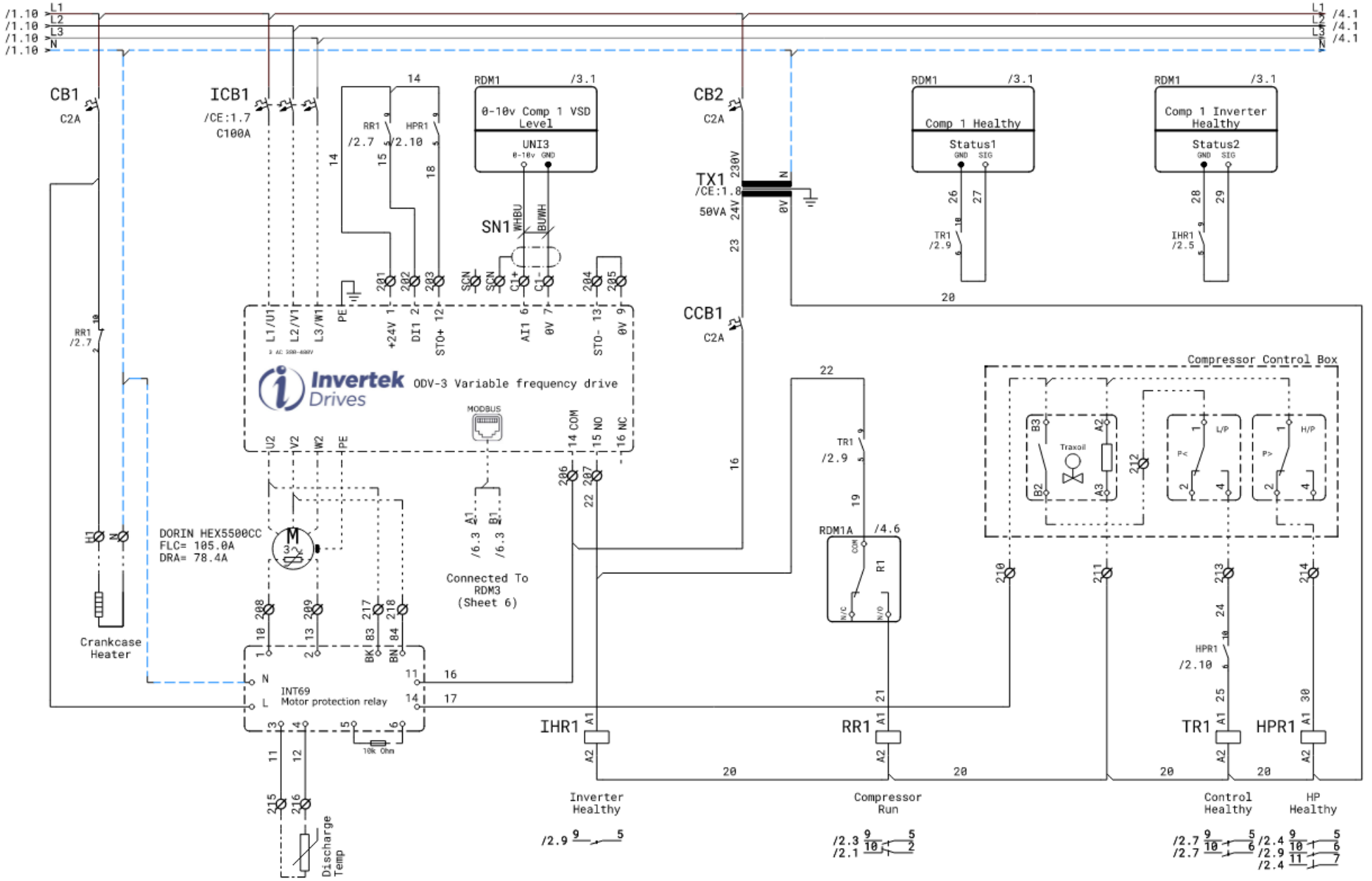
Terminal Layout

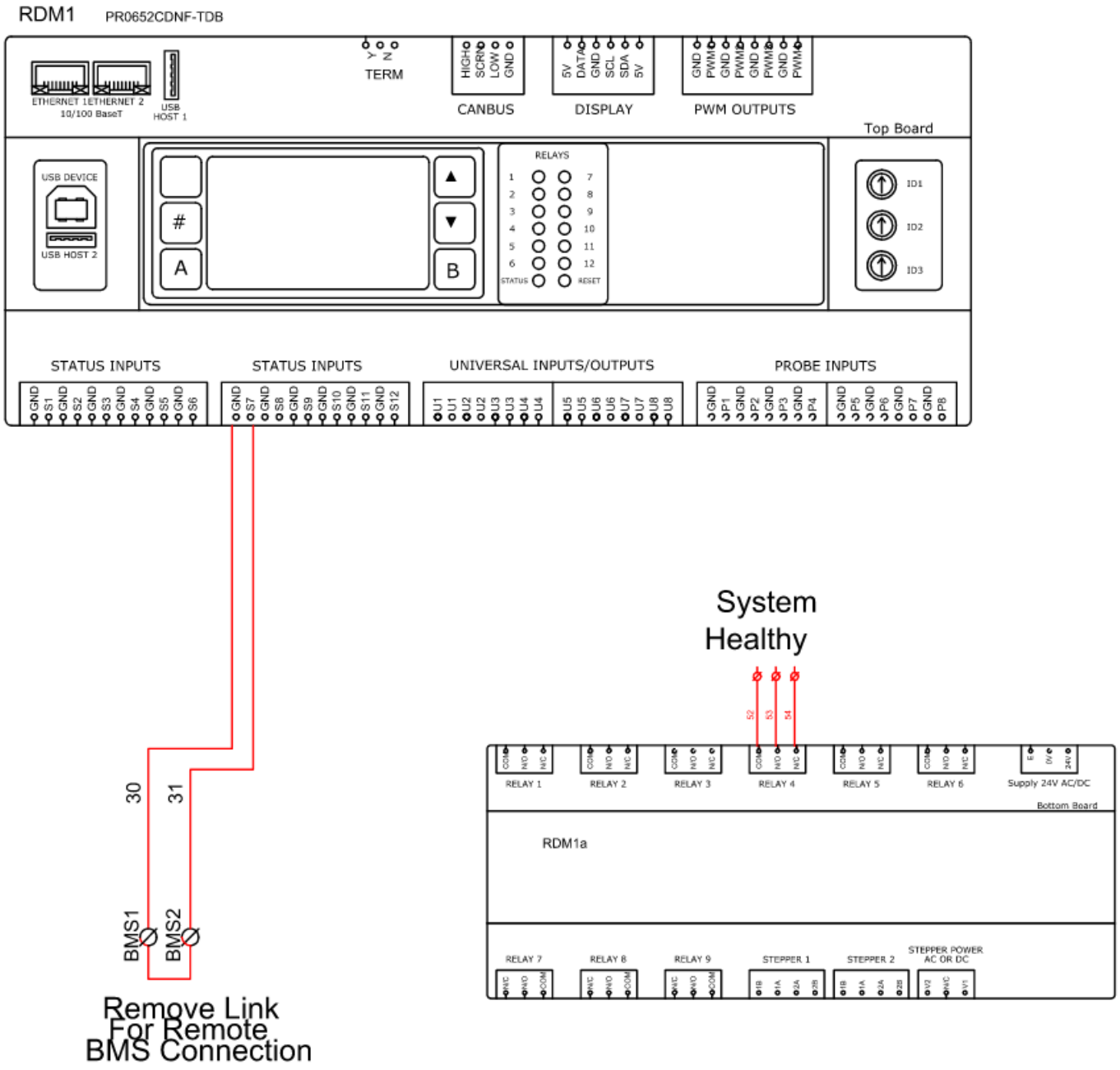
07_Compressor Control

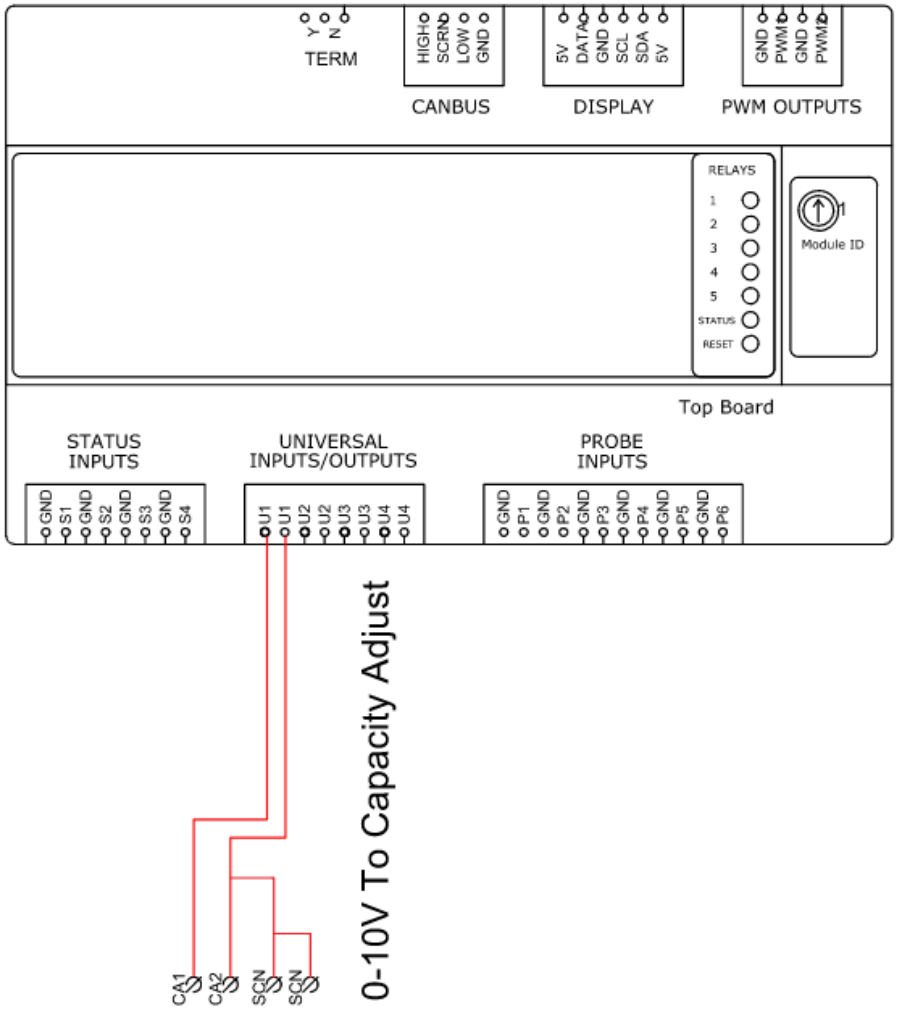


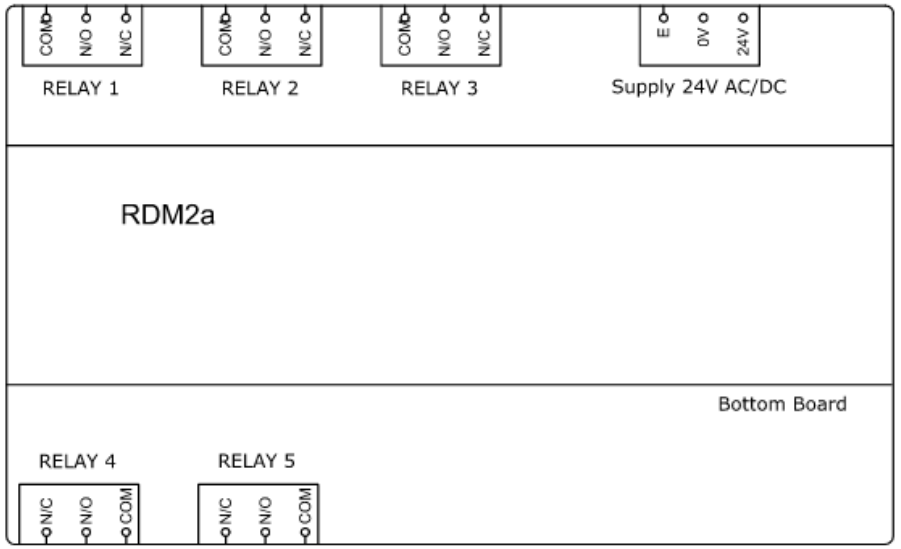
9.2 Elm 80/105 kW Power Wiring

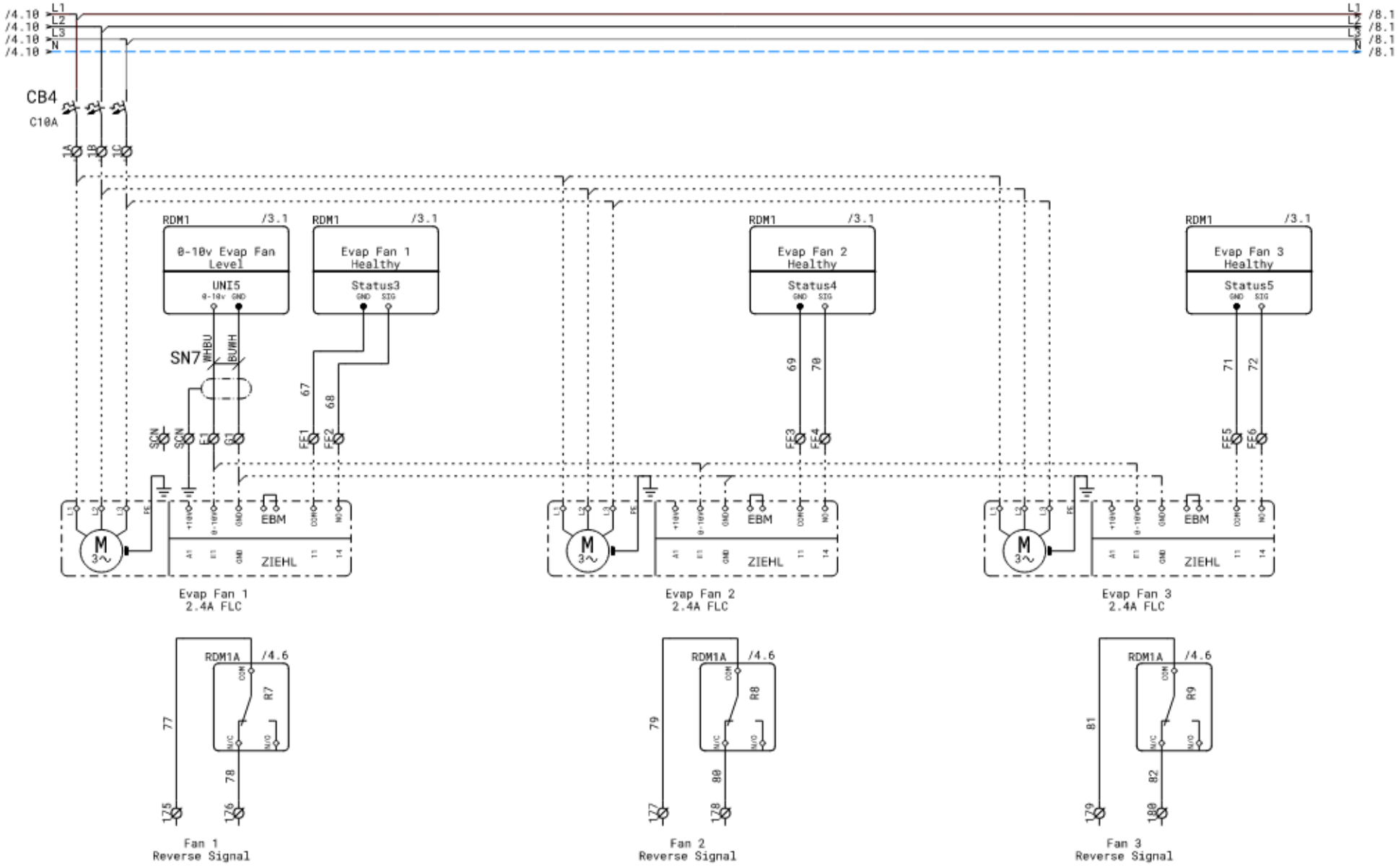


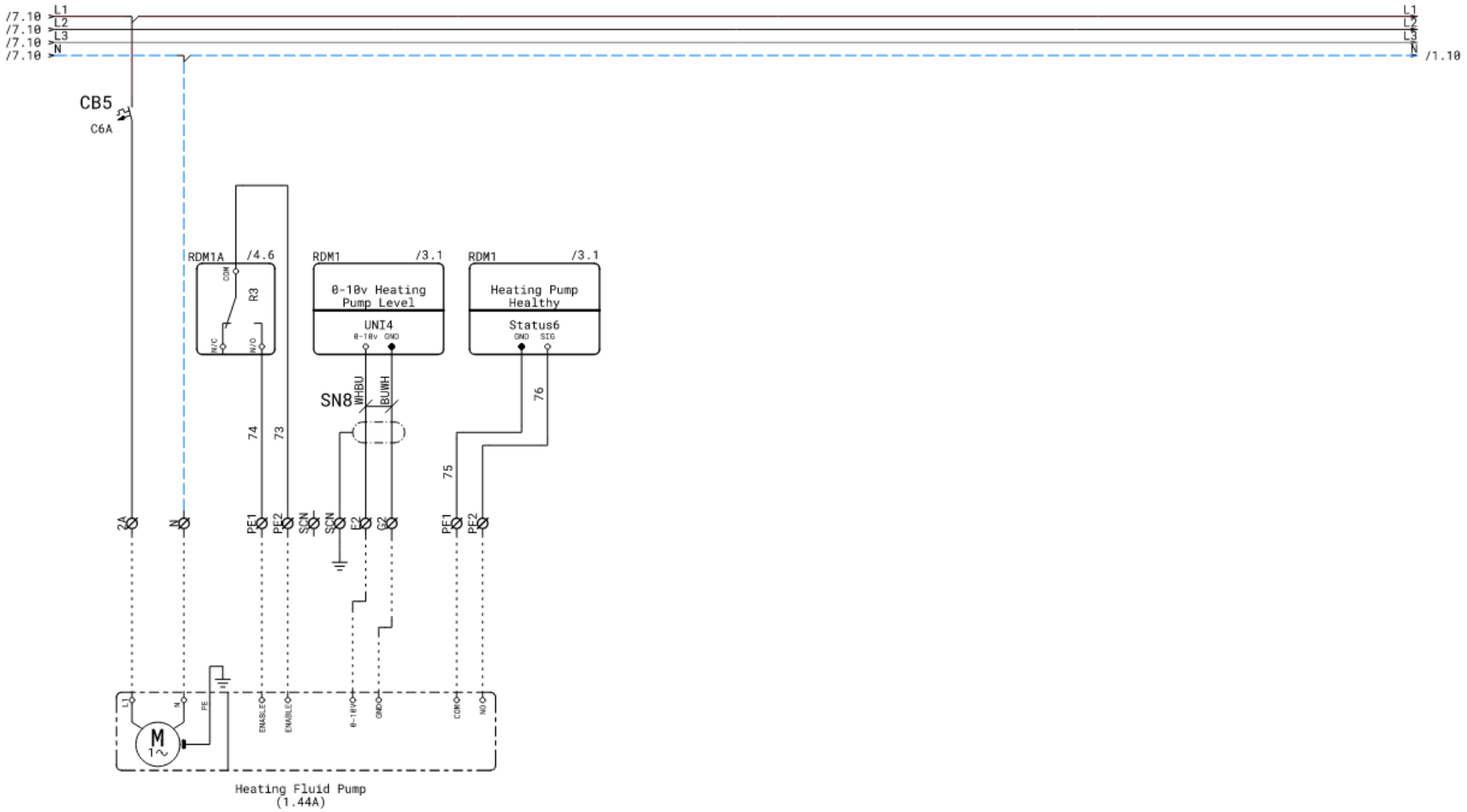

CB1
C2A
ICB1
/CE:1.7
C100A
CB2
C2A
TX1
/CE:1.8
50VA
CCB1
C2A
RDM1 /3.1
0-10v Comp 1 VSD Level
UNI3
Comp 1 Healthy
Status1
Comp 1 Inverter Healthy
Status2
SN1
Invertek Drives
ODV-3 Variable frequency drive
MODBUS
DORIN HEX5500CC
FLC= 105.0A
DRA= 78.4A
Crankcase Heater
INT69
Motor protection relay
Connected To RDM3 (Sheet 6)
Compressor Control Box
Traxoil
RDM1A /4.6
IHR1
RR1
TR1
HPR1
Inverter Healthy
Compressor Run
Control Healthy
HP Healthy
Discharge Temp


RDM1
PR0652CDNF-TDB
ETHERNET 1
ETHERNET 2
10/100 BaseT
USB HOST 1
TERM
CANBUS
DISPLAY
PWM OUTPUTS
Top Board
USB DEVICE
USB HOST 2
RELAYS
ID1
ID2
ID3
STATUS INPUTS
STATUS INPUTS
UNIVERSAL INPUTS/OUTPUTS
PROBE INPUTS
30
31
BMS1
BMS2
Remove Link
For Remote
BMS Connection
System
Healthy
RELAY 1
RELAY 2
RELAY 3
RELAY 4
RELAY 5
RELAY 6
Supply 24V AC/DC
Bottom Board
RDM1a
RELAY 7
RELAY 8
RELAY 9
STEPPER 1
STEPPER 2
STEPPER POWER
AC OR DC

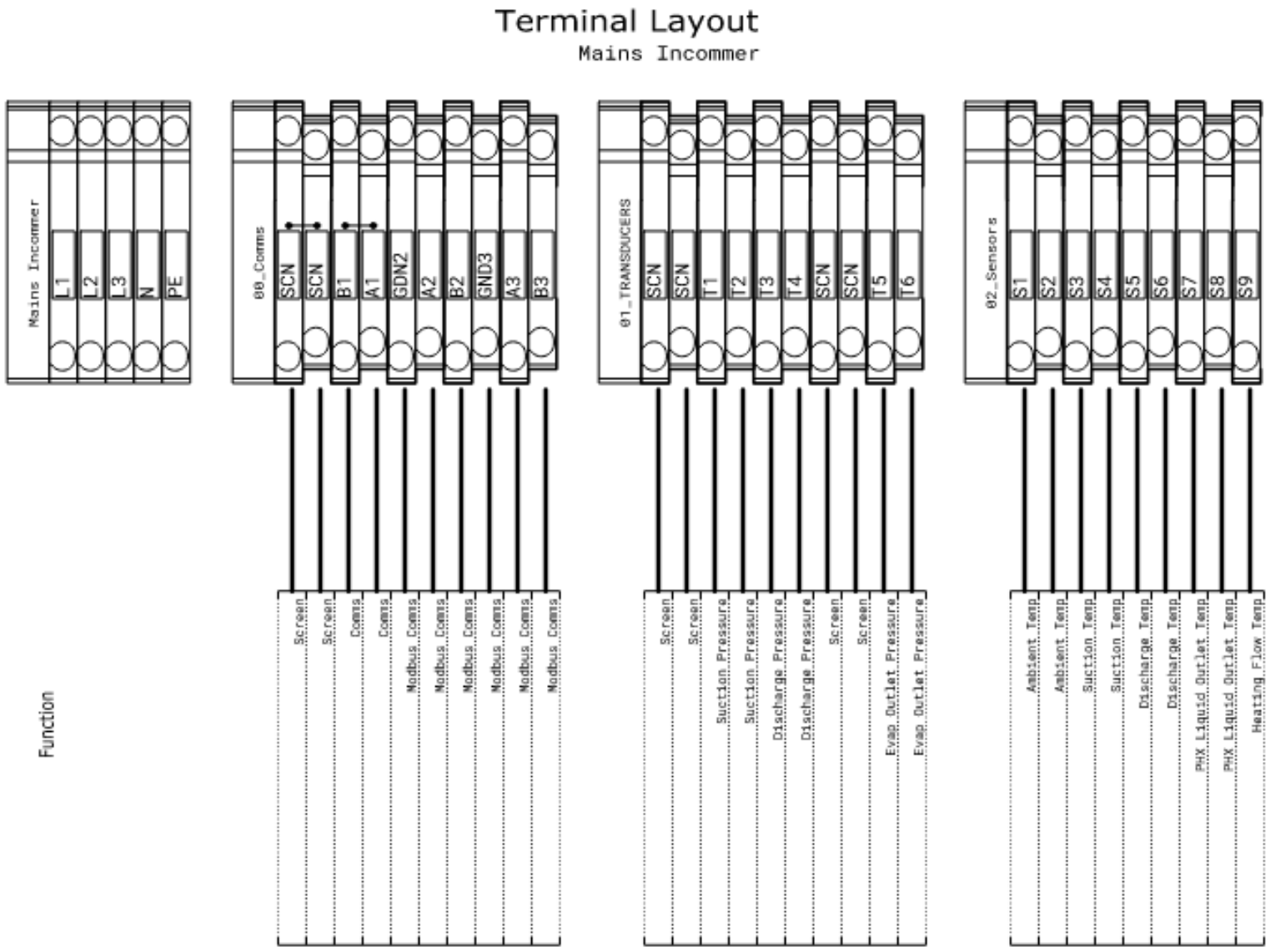

Y N
TERM
HIGH SCRN LOW GND
CANBUS
5V DATA GND SCL SDA 5V
DISPLAY
GND PWM GND PWM
PWM OUTPUTS
RELAYS
1
2
3
4
5
STATUS
RESET
Module ID
Top Board
STATUS INPUTS
GND S1 GND S2 GND S3 GND S4
UNIVERSAL INPUTS/OUTPUTS
U1 U1 U2 U2 U3 U3 U4 U4
PROBE INPUTS
GND P1 GND P2 GND P3 GND P4 GND P5 GND P6
CA1
CA2
SCN
SCN
0-10V To Capacity Adjust

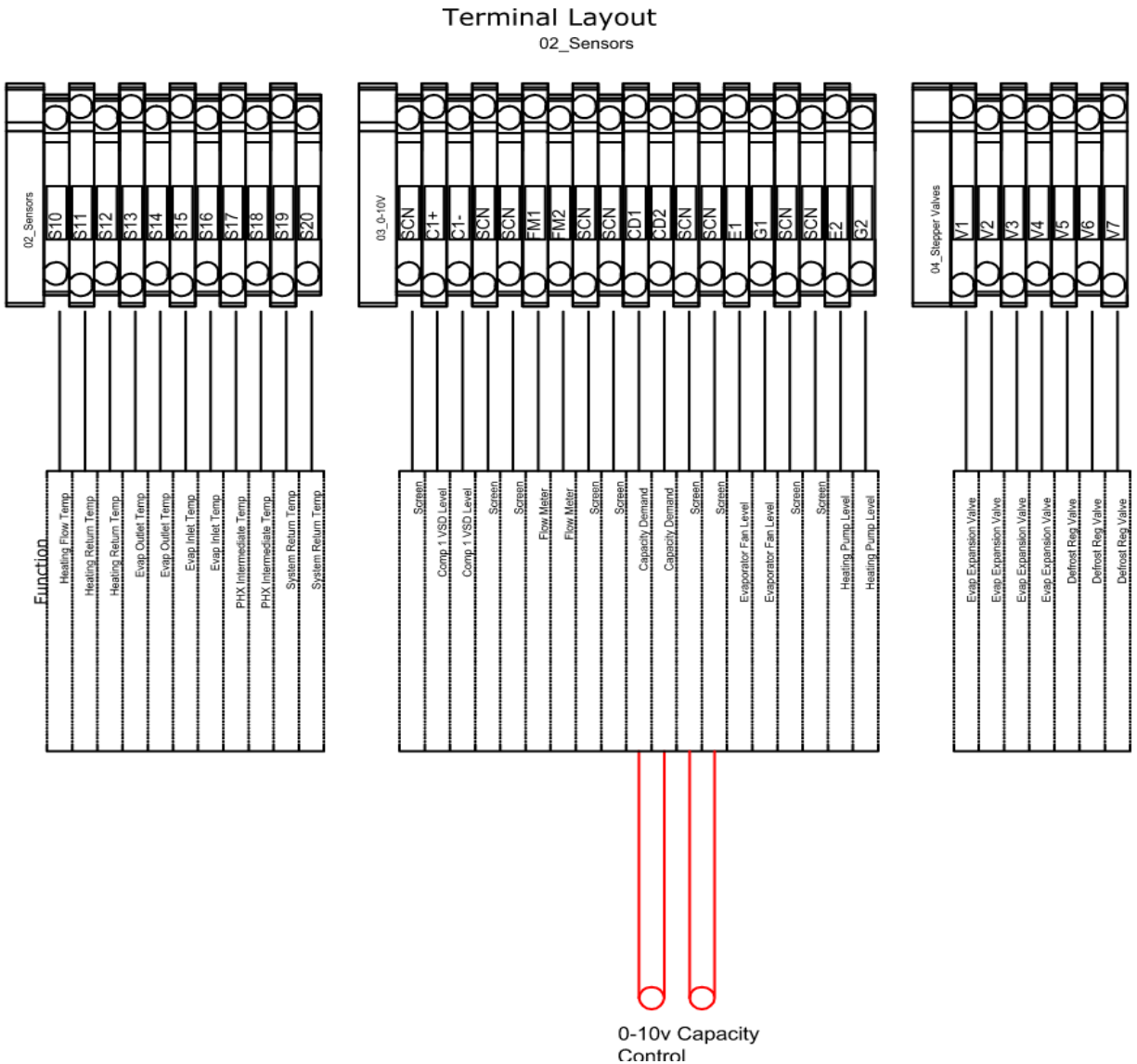

COM N/O N/C
RELAY 1
COM N/O N/C
RELAY 2
COM N/O N/C
RELAY 3
E 0V 24V
Supply 24V AC/DC
RDM2a
Bottom Board
RELAY 4
N/C N/O COM
RELAY 5
N/C N/O COM


/4.10 L1
/4.10 L2
/4.10 L3
/4.10 N
/4.10
/8.1
/8.1
/8.1
/8.1
CB4
C10A
1A
1B
1C
RDM1 /3.1
0-10v Evap Fan Level
UNI5
0-10v GND
RDM1 /3.1
Evap Fan 1 Healthy
Status3
GND SIG
RDM1 /3.1
Evap Fan 2 Healthy
Status4
GND SIG
RDM1 /3.1
Evap Fan 3 Healthy
Status5
GND SIG
SN7
WHBU
BUWH
SCN
SCN
E1
G1
67
68
FE1
FE2
69
70
FE3
FE4
71
72
FE5
FE6
EBM
ZIEHL
Evap Fan 1
2.4A FLC
Evap Fan 2
2.4A FLC
Evap Fan 3
2.4A FLC
RDM1A /4.6
COM
NC
NO
R7
R8
R9
77
78
175
176
79
80
177
178
81
82
179
180
Fan 1
Reverse Signal
Fan 2
Reverse Signal
Fan 3
Reverse Signal


/7.10 L1
/7.10 L2
/7.10 L3
/7.10 N
/7.10
L1
L2
L3
N
/1.10
CB5
C6A
RDM1A /4.6
COM
R3
N/C
N/O
RDM1 /3.1
0-10v Heating Pump Level
UNI4
0-10v GND
RDM1 /3.1
Heating Pump Healthy
Status6
GND SIG
SN8
WHBU
BUWH
74
73
75
76
24
N
PE1
PE2
SCN
SCN
D2
G2
PE1
PE2
L1
N
PE
ENABLE
ENABLE
0-10V
GND
COM
NO
M
1~
Heating Fluid Pump
(1.44A)

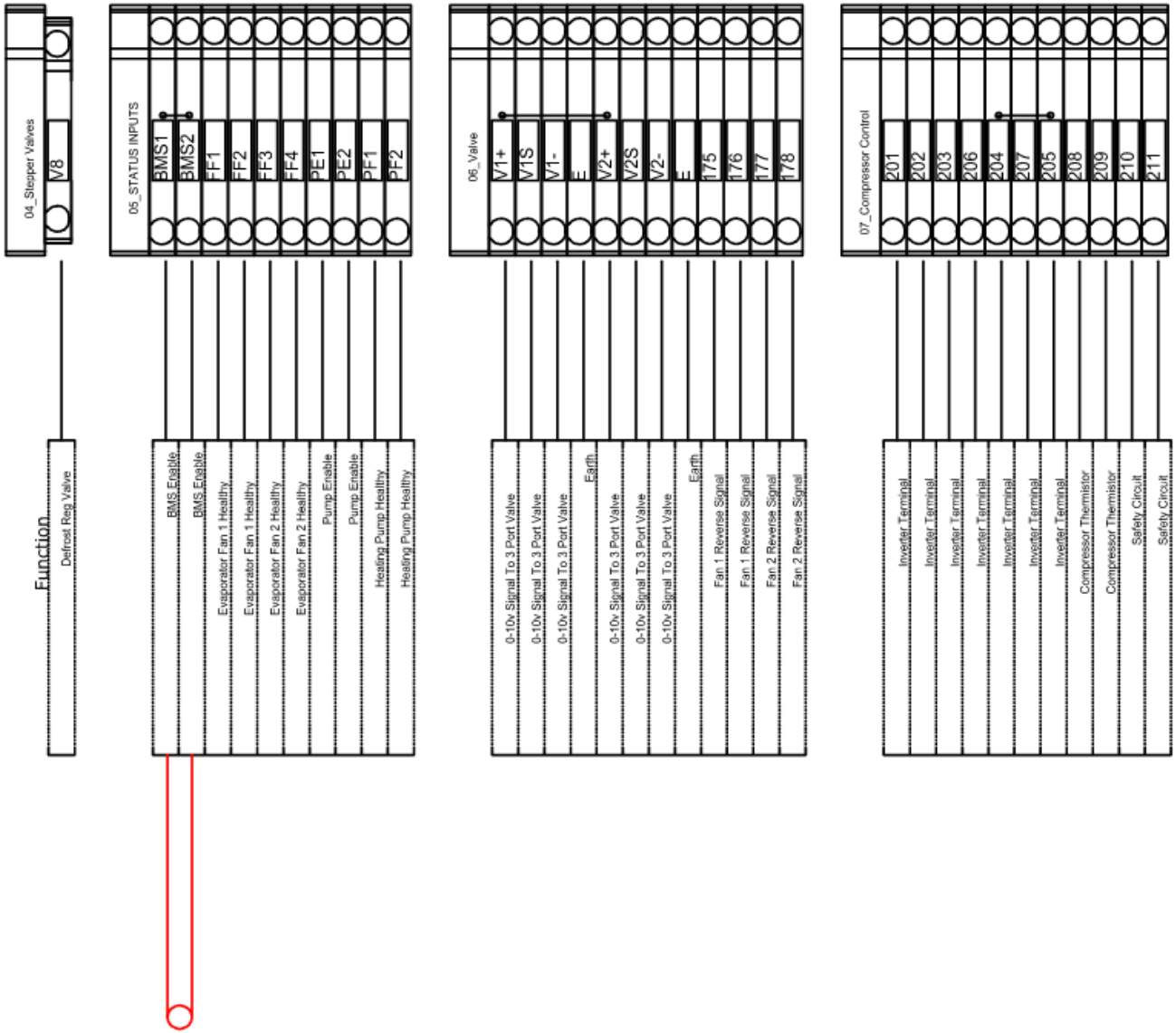
Terminal Layout




Terminal Layout
02_Sensors
02_Sensors
S10
S11
S12
S13
S14
S15
S16
S17
S18
S19
S20
03_0-10V
SCN
C1+
C1-
SCN
SCN
FM1
FM2
SCN
SCN
CD1
CD2
SCN
SCN
E1
G1
SCN
SCN
E2
G2
04_Stepper Valves
V1
V2
V3
V4
V5
V6
V7
Function
Heating Flow Temp
Heating Return Temp
Heating Return Temp
Evap Outlet Temp
Evap Outlet Temp
Evap Inlet Temp
Evap Inlet Temp
PHX Intermediate Temp
PHX Intermediate Temp
System Return Temp
System Return Temp
Screen
Screen
Comp 1 VSD Level
Comp 1 VSD Level
Screen
Screen
Flow Meter
Flow Meter
Screen
Screen
Capacity Demand
Capacity Demand
Screen
Screen
Evaporator Fan Level
Evaporator Fan Level
Screen
Screen
Heating Pump Level
Heating Pump Level
Evap Expansion Valve
Evap Expansion Valve
Evap Expansion Valve
Evap Expansion Valve
Defrost Reg Valve
Defrost Reg Valve
Defrost Reg Valve
0-10v Capacity
Control

Terminal Layout

04_Stepper Valves



BMS ENABLE

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