SPHEROS

SLIM LINE TRAILER REFRIGERATION UNIT

MT180

Operators Manual

ADVANCED TECHNOLOGY – YOU CAN RELY ON.

OWNERS DETAILS

Company Name	
Physical Address	
	Code
Postal Address	
	Code

Tel No. (H)											
Tel No. (W)											
Cell No.											

VEHICLE/FRIDGE DETAILS

Registration No:
Date of Sale:
Model/series:
Unit serial No:
Refrigeration gas type:
PCB Model & Rev:
Software version:

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NOTICES

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SUBMIT FEEDBACK

Southern & Eastern Africa
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ABBREVIATIONS

HMI	Human to Machine Interface
PLC	Programmable Logic Controller
PMG	Permanent Magnet Generator
PPE	Personal Protective Equipment
RPM	Revolutions Per Minute
HP	High Pressure, Condensing Pressure
HPT	Condensing Temperature
LP	Low Pressure, Evaporating Pressure
LPT	Evaporating Temperature
TFP	Top Freeze Protection
LH	Long Haul
USB	Universal Serial Bus
VDC	Voltage Direct Current
EEV	Electronic Expansion Valve
LCD	Liquid Crystal Display
RAT	Return Air Temperature
DAT	Discharge Air Temperature

ICONS

This manual contains icons. For more information, see the table below:

	**Important information**
	**Caution**
	**Mandatory**
	**Check List**
	**Environmental Standards** Actions or checks marked with this icon shows direct impact on the environment and non-compliance.
	**Safety and Health** Actions or checks marked with this icon shows direct impact on safety and health practices.

MT180

INTRODUCTION

The MT180 trailer refrigeration unit is engineered to excel in the most challenging environments, offering precise temperature control and optimal air circulation for unwavering performance. It boasts a range of cutting-edge features, including a state-of-the-art variable speed-controlled diesel engine, innovative variable speed brushless condenser and evaporator fans, and an advanced electronic expansion valve. These advancements guarantee unparalleled product quality and reliability.

Cooling Capacity 30 °C ambient (W) / R404a	0°C	19000
	-20°C	9700
Fan Type		Brushless DC, Axial
Air Volume Flow (m3/h)		10200
Aperture Dimensions W x H (mm)		1700 x 1170
Weight (kg)		880
Compressor	Type	FK40_655
	Cylinders	4
	Displacement (cm^3)	650
Diesel Engine	Type	Yanmar
	Cylinders	4
	Displacement (cm^3)	2190

SAFETY PRECAUTIONS

 Mandatory	The safety precautions listed below, are mandatory for the health and safety of the technicians maintaining the unit and must be followed.

During the course of operations, operators may encounter hazardous chemicals or situations that pose potential risks to their health and well-being. It is crucial to draw the operator's attention to situations or circumstances with a higher risk, which are indicated by the presence of the health and safety warning icon in the manual. However, it should be noted that the absence of this icon alongside instructions or images does not imply that the entire operation is devoid of potential dangers.

Therefore, it is imperative to adhere to general health and safety protocols for working in hazardous environments while operating the unit. This includes taking all necessary precautions such as wearing appropriate protective gear and handling toxic chemicals with utmost care. In case of any uncertainties regarding best practices, operators are advised to consult the resident health and safety officer who possesses the necessary expertise to provide guidance in compliance with local legislation and established health and safety practices.

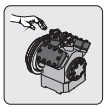
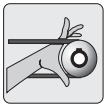
The contents of this manual were prepared and developed in the Republic of South Africa, and therefore the legal jurisdiction is presumed and maintained as such. Where the contents of this publication conflict with the local or regional jurisdiction, the reader is advised that any dispute or legal matter will only be dealt with in the context of South African law, and we accept no liability for loss or damage whatsoever where a conflict between the laws of the Republic of South Africa and the regional or legal jurisdiction of where the unit is used or installed is deemed to have occurred.

Health and Safety Overview

While operating the unit, personnel may be exposed to potential scenarios which may cause personal harm and injury. This would include, but not be limited to potential injury to the eyes, face, and hands depending on the precautions taken along with injuries that may be the result of complacency or human error.

For personal safety it is strongly recommended that PPE (Personal Protective Equipment) always be worn whilst working with the unit. While minimal risk may be posed to the Operator, proper health and safety precautions will protect the operator from any potential injury.

ADDITIONAL SAFETY PRECAUTIONS AND NOTICES

	**High Pressure:** The refrigerant is stored under high pressure and in a liquid state. If the valve is opened or the container punctured, and the refrigerant is sprayed to natural air, there is a high potential for injury to exposed skin and eyes.
	**Hot Surfaces:** The compressor discharges, exhaust pipes and other engine components are extremely hot, and may remain at a high temperature for some time even if the unit has been switched off.
	**Rotational Components:** Fans, pulleys and belts are not visible under certain conditions. Ensure to avoid inserting your hand, fingers or objects into areas where either visibility is poor or a rotating component is in operation. This will prevent injury to the technician or operator and prevent any mechanical damage to the unit.
	**Toxic Gasses:** The refrigerant, is toxic and may cause serious injury and affect breathing. Ensure to work in open well-ventilated spaces and to check for any leaks before working on the unit and as part of the regular maintenance cycles.
	Do not operate the unit if the discharge valve is closed. Always ensure that it has been opened and there are no obstructions and leaks when the valve is opened. Ensure to comply with the maintenance cycles and schedules as this will keep the unit in good running order to prevent risk of breaking down and potential injury.

DISCLAIMER

Warning: All warning and safety precautions mentioned here are for the protection and safety of the operator. Should they be ignored or not followed correctly, no liability is accepted.

Pre-requisites

The following prerequisites identify both the hardware and software skills required by the operator.

Operator Skills

The operator must have a working knowledge of electronic control systems, the use of touch screen activated units and experience on cooling requirements for various cargoes.

Software Updates

Software and/ or firmware updates may be required from time to time, and if this is done on location, please take note of the requirements below:

If a software update has been performed on the PLC, the Visograf is not automatically updated unless the Maintenance Technician initiates an HMI update. This is covered in the Maintenance Manual. Please ensure that only a trained and or qualified technician performs the PLC and Visograf updates.

Hardware Requirements

The USB storage device is used to extract log files from the PLC. No additional PC hardware is required to extract the log files, the system is used to initiate the file transfer onto the USB storage device. See hardware requirements for utilizing this feature below.

Hardware Item	**Description**
USB Key / Flash Drive / Thumb Drive*	16 GB

*USB 2.0 storage devices are supported

- Ensure to use a high-quality USB storage device in good condition or new when extracting the log files.
- If you do have trouble with the USB Storage device not being recognized, try an alternative brand. Differences in manufacturer may result in the device not being compatible with the PLC.

OPERATOR INTRODUCTION

As the Operator, you would be required to be familiar with certain key aspects of the MT180's operation. This information will assist you for example in how to start the MT180, configure the operating mode and shut the unit down after a trip, as well as configure other aspects of the system.

	While some information is provided for information purposes, this does not qualify an operator to attempt repairs on the unit. Repairs and maintenance are reserved for qualified and trained technicians.

Unit Operation

The MT180 is a mobile refrigeration unit, which is powered by a diesel power plant. The Diesel power plant in turn powers the refrigeration unit, and the entire systems is monitored and controlled by the PLC.

Unit Controls

The unit controls for the MT180 are shared between a single, multi-function push button and the HMI. Some functionality is shared between the two interfaces. However, the external push button would be the primary control to activate the system and shut it down when needed.

Start-Stop Button

The Start-Stop button is located on the access panel built into the side of the MT180 and sits alongside a USB port. A single press of the button will start the unit, the startup process taking approximately 1 minute.

	The USB Port is intended for data and control-related access to the MT180, and it is not intended for use as a power supply source for charging mobile devices. Misuse of the port may result in the battery being drained or other electrical complications and should only be used as intended.

HMI CONTROL PANEL

	Caution: The Unit's software and configuration should only be accessed and altered by certified Operators. Altering settings may result in the unit not functioning as required, which may result in damage to the unit and or the loss of product.

The HMI has a large LCD which interfaces with the PLC and reports on and assists in managing the refrigeration unit. The HMI allows the user to access the main screen and companion screens which display the notifications, input, and output resources, and so on.

All Operator screens can be accessed by using **NEXT** and scrolling through the different screens. When a screen contains too much information to fit on a single page the **up ↑** and **down ↓** buttons are used to browse through the different pages on a screen. At any time, the **EXIT** (T8) may be used to Exit back the Home/Default screen

The buttons are addressed as T1 through to T8. You can access a certain screen using a single button or a combination of buttons may be needed to access certain screens or functions.

Item	NAME	Description
1	Running Hours	The diesel engine running hours are displayed here. This can be used as a reference for when the unit will be due for its next service.

HMI CONTROL PANEL

Item	NAME	Description
2	**Primary Mode**	
	MAX	This mode runs all fans at maximum speed, all the time. It is only to be used for trouble-shooting purposes as it provides maximum cooling capacity, even when the set point has been reached. Using this mode during day-to-day operation will result in poor fuel economy, and poor temperature regulation.
	AUTO	This mode should be used during day-to-day operation. It provides the same pull-down performance as MAX mode but reduces condenser fan speed at regulation. This mode provides the best cooling performance, temperature regulation, and fuel economy.
	SLNT	Silent mode should be used in areas where noise pollution regulation exists, or quiet running is required. It slows the condenser fan down as much as possible and limits the engine maximum speed to limit noise. It should not be used as a pull-down mode. It provides good temperature regulation and low noise at the expense of increased fuel consumption.
3	**Secondary Mode**	
	LH	The secondary mode (LH /Long Haul) switches the engine off when the unit reaches set-point. The unit will restart automatically when the box temperature drifts 2.0°C (Adjustable by service dealer) from the set-point. Long Haul can be activated or de-activated on the MODE screen.
4	Box Temperature (RAT)	The current box temperature is reported by the return air temperature probe.
5	Date	The current date.
6	Time	The current time.

HMI CONTROL PANEL

Item	NAME	Description
7	Temperature Trend Indication	This indicator is driven by the actual change in the regulating temperature (RAT). It is independent of the unit mode. When ↓ is displayed the RAT is decreasing. When → is displayed the RAT is remaining constant within a dead-band equal to the hysteresis. When ↑ is displayed the RAT is increasing. The unit can generate several warnings relating to the unit operation in relation to the temperature trend indication.
8	Alarm Bell Indicator	The ringing bell animation is displayed when either critical Alarms or Warnings are present.
9		ALARM and/or WARN is displayed along with the Alarm Bell Indicator to draw the operator's attention to critical Alarms and/or Warnings that are present in the system.
10	Manual Defrost DEF	The DEF combination buttons T6 & T7 triggers a manual defrost. DEF is then displayed on screen instead of the box return air temperature, until such time as the defrost termination parameters are met. There after the display returns to box return air temperature regulation.
11	RESET	The RESET combination buttons T4 & T5 resets the unit *
12	MODE	The RESET combination buttons T2 & T3 accesses the Mode screen.
13	Set-Point	This is the current target temperature for the box return air temperature (4). The unit will cool or heat until the box return air temperature (4) is equal to this Set-Point temperature.
14	Secondary Mode TFP	The secondary mode (TFP /Top Freeze Protection) behaves in accordance with PPECB specified regulations for the transport of perishable goods (i.e., Fresh produce) and prevents the box discharge air temperature from dropping below 0°C. Every time the Set-Point is changed, and the value is above the TFP set-point, TFP will be enabled automatically. If TFP is not required, it can be disabled on the MODE screen (9). TFP will remain disabled even if the unit is switched off completely but will automatically re-enable if the Set-Point is changed and the Set-Point (10) is above the set-point. The set-point can be changed by a service dealer.

HMI CONTROL PANEL

Item	NAME	Description
14	Secondary Mode cont **TFP**	It should be further noted that **TFP** takes precedence over the Set-Point (10). It is possible to have a 0°C Set-Point (10), and a **TFP** set-point of 0°C. In this case the DAT will regulate at 0°C, and the RAT will simply go down to the lowest temperature the box insulation and ambient conditions will allow. Typically, around +3°C to +5°C.
15		This animation is displayed while the unit is in Cooling mode. The RAT (4) is higher than the Set-Point (10). This is typically referred to as the Pull-Down.
		This animation is displayed while the unit is in Regulation mode. The RAT (4) is equal to the Set-Point (10) and the unit is maintaining temperature. In this mode the engine speed is typically at the lowest possible speed, and capacity control is active.
		This animation is displayed while the unit is in Defrost mode. The display of the RAT is replaced by DEF. The evaporator fans are switched off during this time and the evaporator coil is heated to clear ice from the coil. This mode self-terminates when all ice has been cleared from the coil.
		This animation is displayed while the unit is in Heating mode. The RAT (4) is lower than the Set-Point (10).
T1	**SET**	Press once to edit the Set-Point (10). The Set-Point (10) will flash. Press again to confirm the Set-Point (10).
T2	**–**	Decreases the Set-Point Temperature.**
T3	**+**	Increases the Set-Point Temperature.**
T4	**NEXT**	Jump to the Next screen.
T5	**PREV**	Jump to the Previous screen.
T6	**WARN**	Jump directly to the Warnings screen.

HMI CONTROL PANEL

Item	NAME	Description
T7	ALARM	Jump directly to the Alarms screen.
T8	⏻	Pressing the power button will switch the entire system off, both the Engine and HMI. To only switch the engine-off use the Stop/Start button mounted below the HMI.
T2 + T3	MODE	Jumps to the page (12)
T4 + T5	RESET	Resets the unit after an Alarm (11)
T6 + T7	DEF	Initiates a manual Defrost (10)

* Only available when the engine has stopped due to an Alarm.
** Only available if SET has been pressed once, and the set point is flashing

STARTUP AND SHUT DOWN PROCEDURES

Pre-Trip Inspection

The following Pre-Trip Inspection should be completed before starting the unit and loading the trailer. While the Pre-Trip Inspection is not a substitute for regularly scheduled maintenance inspections, it is an important part of the preventive maintenance program designed to head-off operating problems and breakdowns before they happen.

Fuels And Oils

- FUEL: The fuel level must be sufficient to ensure engine operation to the next fuel station.
- ENGINE OIL: The engine oil level should be at the FULL mark as indicated on the oil level indicator dipstick NOT turned (threaded) into oil pan.
- OIL LEAKS: Check for any oil leaks around the engine and compressor.
- COMPRESSOR OIL: Compressor oil must be visible in compressor oil level sight glass. A loss of oil indicates a refrigeration system leak.

Electrical

- BATTERY: The terminals must be clean and tight. Checks for any evidence of corrosion around the battery tray as this can indicate a cracked or over-filled battery. It could also indicate an over-charging issue on the unit.
- ELECTRICAL: The electrical connections should be securely fastened. The wires and terminals should be free of corrosion, cracks, or moisture.

Mechanical

- BELTS: The 2 drive belts (PMG and Water Pump) must be in good condition and adjusted to the proper tensions.
- STRUCTURAL. Visually inspect the unit for leaks, loose, cracked, or broken parts and other damage. The condenser and evaporator coils should be clean and free of debris. Check the defrost drain hoses and fittings to make sure they are open. Make sure all the doors are latched securely.

LOADING PROCEDURE

	**Caution:** Ensure to follow the procedures detailed below to ensure a safe cargo loading event.
	**Mandatory:** Ensure to adhere to all safety procedure during the loading procedure to avoid personal injury and damage to the cargo.

1. Ensure the unit is OFF before opening the doors. This will minimize frost accumulation on the evaporator coil and heat accumulation in the trailer.

	Unit may be running when loading the trailer from a warehouse with door seals.

2. Visually inspect and record the temperature while loading. Check for any off-temperature product.
3. When loading the cargo, ensure that there is adequate space for air circulation around the load. This includes space between the cargo and the walls.

	**Caution:** DO NOT block the evaporator inlet or outlet.

Caution: DO NOT block the evaporator inlet or outlet.

4. The cargo must be pre-cooled before loading. MT180 transport refrigeration units are designed to maintain loads at the temperature at which they were loaded.

STARTUP PROCEDURE

	The unit uses a single button for multiple purposes, so multiple presses will invoke contradictory actions. Please ensure to **PRESS** and **WAIT** for a response from the until before pressing again. During the Start Up procedure and the Self-Test Procedure an hourglass is displayed.

1. Press the Start/Stop button.
2. Wait a moment as the button illuminates, the HMI screen illuminates.
3. The hourglass appears on the HMI screen for approximately 1 minute.

   NOTE: If the button is illuminated in green this indicates that the unit is booting up
4. The hourglass will be replaced by the Default Screen
5. Caution Screens: 2 Caution screens will display
   a. The first is a Pre-Startup check, which includes a hardware check and verifies that the glow / air heating circuit is functioning

b . The second which displays the Caution screen for approximately 14 seconds is the engine startup. The intake air heater is initiated then the engine is started

6. The powerplant will start and run, with the Default Display screen reporting on the unit's status.

CHANGING THE SET-POINT AND MODES

Changing the Set-Point

To change the Set-Point, do the following:

1. Press the **SET** (T1) button once. Check that the Set-Point is flashing.
2. Change the Set-Point up or down using the **+** (T3) or **–** (T2) buttons.
3. Confirm the Set-Point change by pressing **SET** (T1) again. Check that the Set-Point is no longer flashing.

Changing the operating Modes

To change the Primary or Secondary Mode, do the following:

1. Press the **MODE** (T2 & T3) buttons simultaneously.
2. HMI jumps to the Modes screen.
3. Change the Primary mode by pressing **AUTO** (T1) (Recommended), **MAX** (T2) or **SLNT** (T3).
4. Select the Secondary modes by pressing **LH** (T7) and/or **TFP** (T6).
5. Press **EXIT** (T8) to return to the Default screen.

SHUTDOWN PROCEDURE

	There are two options: 1. Suspend cooling (Includes a time delay of 30 minutes until HMI and Control auto shut down). If the unit is fitted with an optional door sensor the delay time is extended to 90 minutes. 2. Complete Shutdown. A complete shut will switch off the engine, as well as the HMI and Control.

Temporarily Suspend Cooling

To stop the engine, do the following:

1. Locate the Start/Stop button located beneath the HMI, which should be illuminated in green.
2. Press the button once, and this will shut off the engine, suspending cooling. The engine will not restart unless the Start/Stop button is pressed again.

   NOTE: The HMI will remain powered on. This will allow the unit to be restarted without having to go through the 1-minute start-up procedure.

To restart the engine, do the following:

1. Press the Start/Stop button once and the engine will restart
2. If the unit is not restarted, the unit will shut itself down after 30 minutes. If operation was suspended by the optional door sensor, the auto shut down time is extended to 90 minutes.

Complete Unit Shutdown

To shut the unit down completely, do the following:

1. Locate T8, on the right-hand side of the HMI
2. Press and hold T8 for at least 3 seconds
   a. The engine will shut down.
   b. 3 seconds later the HMI will switch off completely.

	This procedure will also work if the unit is in Suspend mode, and the engine is already off.

SHUTDOWN PROCEDURE

Complete Unit Shutdown – Using the Start/stop button

To shut down the unit, do the following:

1. Hold the Start/Stop button down for 5 seconds.
2. The engine will switch off.
3. After the Start/Stop button is released and the engine has come to a complete stop, the HMI will switch off after 3 seconds.

Failed Start

If engine fails to run successfully for 2 minutes after start-up, the control will attempt to restart the engine. This process will be repeated 3 times, after which the unit will enter Priming Mode for 5 minutes. During Priming Mode, the electric fuel pump will run. This will be followed by another 3 start attempts, and another 5-minute priming mode. After the second 5-minute priming, the engine will attempt to start another 3 times. If the engine failed to start after the 9th start attempt an Alarm will be generated, which can be viewed by pressing the ALARM button. In the case of such a failed engine start the message will read 3411 Engine Failed to Start. Press the EXIT button to return to the Default screen. To clear the alarm and reset the unit, do the following:

1. Firstly, confirm that the unit is in error, and the  ALARM icon showing on the Default screen.
2. Pressing buttons T4 and T5 simultaneously will RESET the unit. Alternatively the Start/Stop button can be pressed briefly.
3. The Alarm will clear, and the unit will attempt to restart again using the same process.

	Clearing the alarm does not resolve the issue causing the engine not to start.

MODES OF OPERATION

The primary modes dictate maximum engine speed, the condensing temperature and temperature control accuracy. Auto mode is always recommended as it provides the best performance, fuel economy and temperature regulation accuracy.

The secondary modes can either be used individually, or all at the same time, or none of them, with any of the primary modes. Typical mode combinations are:

AUTO	The engine will run continuously, with no limitation or regulation on DAT. Temperature control will be on RAT only.
AUTO LH	Unit will run in Auto mode, but the engine will switch off and on automatically once the Set-Point has been reached. There is no limitation or regulation on DAT. Temperature control will be on RAT only.
AUTO LH TFP	Unit will run in Auto mode, but the engine will switch off and on automatically once the Set-Point has been reached. The DAT will be regulated and not allowed to cool below 0°C, or the Top Freeze Protection set-point (if it has been changed by a service dealer).

How to enter the Mode menu

To enter the Mode menu, do the following:

1. Locate the two Buttons T2 & T3
   a. These are the buttons with the symbols + & −, and
   b. The MODE label is displayed above them.
2. Press T2 & T3 simultaneously to enter the modes screen.
3. To change the mode, press the buttons along the base of the screen, which will change the mode
4. The mode change is applied immediately and does not require confirmation.
5. Press EXIT to return to the Default screen.

MODE OPTIONS

Once you have entered the Mode menu, the mode options labels will be suspended on the screen above the T buttons.

Button	Label	Long Name	Description
T1	AUTO	Automatic	Manages the engine speed, condenser fan speed and evaporator fan speed automatically. This is the recommended Primary mode.
T2	MAX	Maximum	Maximum cooling. Poor temperature regulation, poor fuel consumption. This is a Primary mode.
T3	SLNT	Silent	Silent operation. This is a Primary mode.
T6	TFP	Top Freeze Protection	Secondary mode. Can be used with any Primary and Secondary mode combination. Enables protection for perishable cargo.
T7	LH	Long Haul	Secondary mode. Can be used with any Primary and Secondary mode combination. Enabled for long-distance transport. The engine will shut down and restart automatically based on cooling and heating requirements.
T8	EXIT	Exit	Returns to the Default screen.

Long Haul Mode

Long Haul Mode is activated by the operator once the trailer has been closed and secured for travel. The engine, once running, will run until the set point temperature is reached. When at temperature, the engine switches off, and the temperature is monitored continuously. If it reaches 2°C above or below the setpoint, the engine will restart.

When the engine restarts, it will run for a minimum of 10 minutes per restart, and this is to recharge/maintain the unit's battery level.
The 2°C Long Haul hysteresis can be changed by a service dealer.

Long Haul Mode results in significant fuel savings. Upwards of a 50% saving can be achieved on fuel consumption depending on the setpoint, load temperature, ambient conditions, and box insulation quality.

MODE OPTIONS

Automatic Mode

In Automatic Mode, the condenser and radiator fans do not run at full speed continuously unlike in Maximum mode. During the initial pull-down or cooling phase to reach the setpoint temperature, the fans run at full speed as this produces maximum cooling regardless of ambient conditions. Once the setpoint has been reached, the condenser fans will slow down along with the engine speed. This provides additional power for the evaporator fans to maintain optimal air circulation.

Maximum

In Maximum Mode, the unit will run all the fans at maximum speed continuously. This mode is not intended for daily use and is highly inefficient resulting in excessive fuel consumption.

Silent

Silent mode is intended for use at night or in noise sensitive areas. To reduce the level of noise produced by the unit, the engine speed is reduced from the maximum of 2200rpm to 1800rpm. Additionally, the speeds of the condenser and radiator fans are reduced to reduce the amount of noise produced.

Defrost

A manual Defrost can be triggered from the default screen. A defrost is initiated when needed and requires the unit to be running before the control unit will accept the input.

TFP – Top Freeze Protection

TFP as a system feature is designed to protect perishable cargo for example fresh fruits and -vegetables. Perishable items are susceptible to damage if the air exiting the unit is below freezing. If TFP is enabled, and the operator reduces the set point below zero, TFP then disables automatically, and the operator is not able to force TFP back on in the mode screen because the set point is below zero (Or below the TFP setpoint if it was changed by a service dealer).

TFP is activated automatically if the temperature set point is increased above 0°C (the TFP setpoint), and the feature is seen in the Mode screen as activated. If TFP is manually deactivated, it will reactivate if the set point is changed again and the conditions above are met. TFP will govern the system operation regardless of the primary mode selected.

i	TFP can be disabled by the operator.

MODE OPTIONS

Priming Mode

Priming Mode is part of the startup procedure that comes into effect when there is a failed attempt to start the unit, or the engine stops unexpectedly in the first 2 minutes after start-up. The failed start is owing to lack of fuel, air in the fuel line, a blocked fuel filter, a blown fuse or any relevant condition preventing a successful start.

When the unit attempts the first-time start and the start fails, it will attempt two further starts for a total of three before the unit goes into priming mode for 5 minutes. The unit will try again a further three times before priming mode is attempted a second time, again for 5 minutes. Finally, three more attempts are made to start the unit and then the unit will not attempt any further engine starts.

This means that 9 attempts are made with two priming events to attempt to start the unit. If after these attempts, the unit fails to start then operator intervention is needed to resolve the issue.

On the default screen, the Alarm or Warning indicator is shown, notifying the user that a fault has been detected.

POST TRIP INSPECTION

	The following post-trip inspection should be completed by an experienced technical resource.

1. Cleaning the unit

a. Clean the exterior of the unit

b. Visually inspect for any debris i.e., packaging, plant material or other items that may have been left behind

2. Check for Leaks
    a. Visually inspect for any leaks
3. Check for loose or missing hardware.
    a. Ensure that none of the unit's assembly, panels or components have come loose or dislodged
4. Visually inspect for any physical damage to the unit

PAGE AND SCREEN SEQUENCE AND LAYOUT

The HMI enables some access to maintenance level screens on a read only basis.

Name	Button Access	Pages per Screen	Description
Default Screen	Default Screen	1	Displays at startup and can be returned to with EXIT (T8) from any other screen.
Modes Screen	PREV / NEXT	1	Unit Primary and Secondary operating modes are set here. Also displays average fuel consumption and if in pull down the time remaining to reach the set point. If the unit is in Defrost it will display the time remaining in Defrost.
Service (Read)	PREV / NEXT	3	Displays run hours remaining till next services, and what type of service will be needed. Also displays various statistics used for planning and preventative maintenance. The total number times the starter motor has engaged. This is used to calculate starter motor life, so that planning can be made for a pre-emptive replacement of the starter motor before failure. The total runtime of the starter motor. This is used to calculate starter motor life, so that planning can be made for a pre-emptive replacement of the starter motor before failure. The total number of revolutions that the engine has done. This is used to calculate time to an engine rebuild. Average crank time. This is the long term average starter motor crank time that the engine requires to start. A trend in the last crank times triggers a pre-emptive warning if the unit is consistently taking longer than the average crank time to start. This allows for pre-emptive trouble shooting of the fuel system, air system, and any other causes of hard starting.
Date Time	PREV / NEXT	1	Allows the date and time to be set. This is used in log files, and is also the date and time displayed on the Default screen. The HMI language can also be changed here to provide better operator experience in supported languages.

PAGE AND SCREEN SEQUENCE AND LAYOUT

Name	Button Access	Pages per Screen	Description
Logger Screen	Default Screen	1	Displays instructions for data log downloading via USB.
Warning Screen	PREV / NEXT	4	Displays Warning conditions that require attention, servicing or repairs, but do not interrupt operation. Though decreased performance and poor fuel consumption may result from these warnings being present.
Alarms Screen	PREV / NEXT	4	Displays Alarm conditions owing to system faults that interrupt operation.
Technical Screen	PREV / NEXT	5	Displays Alarm conditions owing to system faults that interrupt operation.
Inputs Screen	PREV / NEXT	4	Displays a full list of technical values for diagnostic or review purposes.
Output Screen	PREV / NEXT	3	Displays raw output values for diagnostic purposes.

PAGE AND SCREEN SEQUENCE AND LAYOUT

T5/ NEXT (Technical Screen)

Item	Name	Description
Amb Temp	Ambient Temperature	Temperature recorded in °C of the ambient air that enters the condenser coil
Set Temp	Set Point Temperature	Set Point Temperature that the unit will achieve for the air return temperature inside the box (Box Temp) in °C
Box Temp	Box Temperature (RAT)	Temperature recorded in °C of the return air that enters the evaporator coil
AOff Temp	Discharge Air Temperature (DAT)	Temperature recorded in °C of the discharge air that exits the evaporator fans
Coil Temp	Evaporator Coil Temperature	Temperature recorded in °C of the evaporator core
CmpD Temp	Compressor Discharge Temperature	Temperature recorded in °C of the refrigerant that exits the compressor
HPT Temp	Condensing Temperature	Pressure in the discharge piping of the compressor converted to temperature °C
LiqL Temp	Liquid Line Temperature	Temperature recorded in °C of the liquid refrigerant that exits the liquid receiver
SucL Temp	Suction Line Temperature	Temperature recorded in °C of the refrigerant that exits the evaporator
LPT Temp	Evaporation Temperature	Pressure in the return piping to the compressor converted to temperature °C
Eng Temp	Engine Coolant Temperature	Temperature recorded in °C of the engine coolant
SuperHeat	Evaporator SuperHeat	Difference in temperature calculated in °C between the evaporation temperature (LPT Temp) and suction line temperature (SucL Temp)
Sub Cool	Condenser Sub Cooling	Difference in temperature calculated in °C between the condensing temperature (HPT Temp) and liquid line temperature (LiqL Temp)
HP (BarG)	Condensing Pressure in Bar Gauge	Pressure recorded in Bar (Gauge) in the discharge piping of the compressor

PAGE AND SCREEN SEQUENCE AND LAYOUT

Item	Name	Description
LP (BarG)	Evaporation Pressure in Bar Gauge	Pressure recorded in Bar (Gauge) in the return piping to the compressor
Coil Temp	Evaporator Coil Temperature	Temperature recorded in °C of the evaporator core
CmpD Temp	Compressor Discharge Temperature	Temperature recorded in °C of the refrigerant that exits the compressor
EEV Steps	Amount of EEV steps open	Amount of EEV steps open
Air kW	Air temperature change power.	Capacity (W) as calculated from the air flow volume, RAT (Box Temp) and discharge air temperature (AOff Temp)
Ref kW	Refrigeration Capacity as calculated from the compressor manufacturer data, and the current running conditions of the compressor	Capacity as calculated from condensing temperature (HPT Temp), evaporation temperature (LPT Temp), superheat (SuperHeat), and compressor speed (Eng Speed)
Compr KW	Compressor Input power as calculated from the compressor manufacturer data, and the current running conditions of the compressor	Compressor power consumption as calculated from condensing temperature (HPT Temp), evaporation temperature (LPT Temp), superheat (SuperHeat), and compressor speed (Eng Speed)
Total Kw	Sum of compressor power consumption and fan power consumption	Sum of compressor power consumption and fan power consumption
COP	Total Coefficient of Performance calculated as the coefficient of Ref kW and Total kW	Total Coefficient of Performance calculated as the coefficient of Ref kW and Total kW
HP Ctrl	HP Control. Condensing pressure control.	The amount (0-10000, 0-100.00%) that the EEV is closed from its optimal superheat opening to keep the HP inside the compressor operational envelope. 0 means no control
LP Ctrl	LP Control. Evaporating pressure Control.	The amount (0-10000, 0-100.00%) that the EEV is closed from its optimal superheat opening to keep the LP inside the compressor operational envelope. 0 means no control

PAGE AND SCREEN SEQUENCE AND LAYOUT

Item	Name	Description
Temp Ctrl	Temperature Control. RAT Control.	The amount (0-10000, 0-100.00%) that the EEV is closed from its optimal superheat opening to keep temperature at set point. 0 means full cooling.
L/hr AVG	Litres per hour (Average).	Engine fuel consumption average for the current trip.
L/hr	Litres per hour.	Instant current fuel consumption.
CondF Spd	Condenser fan speed.	Condenser fan speed (0-10000, 0-100.00%)
EvapF Spd	Evaporator fan speed.	Evaporator fan speed (0-10000, 0-100.00%)
LP Ctrl	LP Control. Evaporating pressure Control.	Decreasing the Evaporator fan speed to assist with lowering high LP.
CapCon1	Capacity Control 1.	Duty cycle of capacity control head 1. (0-10000, 0-100.00%)
CapCon2	Capacity Control 2.	Duty cycle of capacity control head 2. (0-10000, 0-100.00%)
Litres Used	Litres Used.	Litres of diesel fuel used so far in the current trip.
Eng Speed	Engine Speed rpm.	Engine speed in revolutions per minute.
12V DC	Current voltage in the 12V DC circuit.	Current voltage in the 12V circuit. 13.7-14.0V while the unit is running. 16.0 and above will trigger an alarm and shut the unit down.
24V DC	Current voltage in the 24V DC fan circuit.	Current voltage in the 24V fan circuit, only displayed while the unit is running. Should be between 20.0V-32.0V.
Eng Temp	Engine Temperature.	Current engine coolant temp (°C).
Oil Press	Oil Pressure switch state.	Oil Pressure switch state (Good/Bad). The oil pressure must be "Bad" in order for the unit to start, else the control will assume the unit is already running if the oil pressure is "Good". An alarm will trigger if the oil pressure is "Bad" while the engine is running, and the unit will shut down.

PAGE AND SCREEN SEQUENCE AND LAYOUT

Item	Name	Description
Coolant T	Coolant Temperature switch state.	Status indication for coolant (Good/Bad). Must always be "Good". An alarm will trigger, and the unit will shut down if the state is "Bad" at any time.
Spd Ctrl	Speed Control (Engine).	Current output to the engine speed controller (0-10000, 0-100.00%) Spd Ctrl = Base engine speed + Set Spd – MaxV Spd – MaxHP Spd – MaxE Spd – MaxC Spd.
Set Spd	Set Point Speed.	Speed increase (0-10000, 0-100.00%) resulting from the difference between the current RAT and the set point.
MaxV Spd	Maximum Voltage (24V DC) Speed.	Speed decrease (0-10000, 0-100.00%) resulting from the 24V DC fan circuit exceeding 32.0V.
MaxHP Spd	Maximum HP Speed.	Speed decrease (0-10000, 0-100.00%) resulting from the HP exceeding the HP regulation set point.
MaxE Spd	Maximum Engine Temperature Speed.	Speed decrease (0-10000, 0-100.00%) resulting from the Engine Coolant Temperature exceeding the recommended temperature.
MaxC Spd	Maximum Compressor Temperature Speed.	Speed decrease (0-10000, 0-100.00%) resulting from the Compressor Discharge Temperature exceeding the recommended temperature.
Total Engine Starts	Total Engine Starts	The total amount of times the engine starter motor has engaged to start the engine.
Total Starter Runtime	Total Starter Runtime	The total minutes that the engine starter motor has run.
Average Crank Time	Average Crank Time	The long term average time the engine starter motor is engaged for every engine start event.
Last Crank Time	Last Crank Time	The amount of seconds the starter motor was engaged for the last engine start event. A trend in the last crank times triggers a pre-emptive warning if the unit is consistently taking longer than the average crank time to start. This allows for pre-emptive trouble shooting of the fuel system, air system, and any other causes of hard starting.
Total Engine Revs x1000	Total Engine Revs x1000	The engine has made this number of revolutions in total, multiplied by 1000.

PAGE AND SCREEN SEQUENCE AND LAYOUT

Data Logger

The Data Logger feature captures data to a standard USB Key, which must be below 16GB in capacity. The USB Key is inserted into the PLC, and then logs are written to the key in text format, which is compatible with most desktop PCs.

To insert the USB Key, do the following

1. Scroll to the Datalogger screen, and if no key is currently inserted the user will be prompted to insert one.
2. Insert the Key (<16GB), and the unit will automatically begin copying files
   a. The PLC will first detect the USB key with the message **USB Mounted**
   b. Copying is indicated by the message COPYING . . . and the name of the files
3. Once complete, the Control Unit will indicate that the key can be removed
   a. The unit will display the message COPY COMPLETE, REMOVE USB STICK
   b. Remove the USB Stick from the PLC
4. Once removed the screen will display the message **No USB Key Inserted**
5. Pres. **EXIT** (T8) to return to the Default Screen

FAULT STATES

The unit can generate 2 different types of Faults. Either Alarms, or Warnings.

Alarms are critical faults that will lead to damage to the unit if the unit carries on running. The engine is automatically shut down if an alarm occurs. Once the unit has stopped, the system can be reset by pressing buttons T4 and T5 together. Alternatively, the Stop / Start / Reset button can be pressed once momentarily.

Warnings are non-critical faults that indicate problems with the unit, but there is no danger to the unit. The unit will continue operating. Some warnings result in the unit running in safe mode with reduced capacity, while other warnings allow the unit to continue operation at full capacity.

The unit should be inspected by a dealer as soon as possible since the warnings can be an indication of an impending alarm, which will shut down the unit.

Resetting the unit will clear the Warning or Alarm, but it does not resolve the error causing it. If the error persists, then the unit may require maintenance.

Resetting the unit will clear the Warning or Alarm, but it does not resolve the error causing it. If the error persists, then the unit may require maintenance.

On the default screen, the Alarm or Warning indicator is displayed notifying the user that a fault state has been detected.

ALARM CODES

Alarm Code	Alarm Text	Description
1101	Regulation Probe Fault	Connection to both RAT and DAT probes has been lost. Temperature control is impossible.
1141	Suction Probe Fault	Connection to Suction line probe has been lost. EEV opening calculation is impossible.
2111	HP Sensor Fault	Values returned by HP transducer are impossible for current running conditions.
2121*	HP High	HP transducer values indicate the system is operating at a pressure above the compressor maximum pressure
2211	LP Sensor Fault	Values returned by LP transducer are impossible for current running conditions.
2221*	LP Low	LP transducer values indicate the system is operating at a pressure below the compressor minimum pressure
3011	Oil Pressure Low	Engine oil pressure is too low to allow for engine operation.
3111	Engine Coolant Overheat	Engine coolant temperature is too high to allow for engine operation.
3211	Engine Speed Fault	Engine speed is outside design specifications posing a danger to the engine, coupling and compressor.
3411	Engine Failed Start	Engine has failed to start after 3 attempts. The engine will attempt a total of 9 times with automatic priming events, after which the engine will no longer attempt to start.
5021	Battery Voltage High	Voltage applied to battery and control system is too high and risks electrical damage to the control and battery.
6021	Compressor Overheat	Internal compressor temperature switch indicating the compressor is too hot for operation.
10111	EEV Comms Fault	Communication with the EEV driver module has been lost.
10511	IPX Comms Fault	Communication with the expander module has been lost.

WARNING CODES

Warning Code	Warning Text	Description
11	Engine Oil Service Due	Less than 100 hours remain till the engine oil should be changed, along with the engine oil filter/s
12	Engine Air Filter Service Due	Less than 100 hours remain till the air filter element should be changed
13	Engine Coolant Service Due	Less than 100 hours remain till the engine coolant should be flushed out and changed
14	Engine Fuel Injector Service Due	Less than 100 hours remain till the engine requires a major service including injector pump timing
21	Water Pump Belt Replacement Due	Less than 100 hours remain till the engine water pump belt requires replacement
22	PMG Belt Replacement Due	Less than 100 hours remain till the PMG belt requires replacement
31	Fuel Pump Filter Service Due	Less than 100 hours remain till the fuel filter (at the fuel pump) should be changed, and fuel pump strainer and bowl cleaned
32	Engine Fuel Filter Service Due	Less than 100 hours remain till the fuel filter (at the engine) should be changed
41	Compressor Oil Service Due	Less than 100 hours remain till the compressor oil should be flushed out and changed
1001	Setpoint too close to Top-Freeze Setpoint	Setpoint should be more than 3°C above the TFP setpoint. The TFP setpoint takes priority over the RAT setpoint. If this warning is ignored the unit will not reach the RAT setpoint
1111	Box Temp (RAT) Probe Fault	The RAT probe circuit is faulty. The unit will continue to run on a simulated value based on DAT. The unit must be inspected by an approved service dealer immediately after freight has been unloaded
1131	Discharge Air Temp (DAT) Probe Fault	The DAT probe circuit is faulty. The unit will continue to run on a simulated value based on RAT. The unit must be inspected by an approved service dealer immediately after freight has been unloaded
1311	Compressor Discharge Temp Probe Fault	The compressor discharge temperature probe circuit is faulty. The unit will continue to run. The unit must be inspected by an approved service dealer immediately after freight has been unloaded

WARNING CODES

Warning Code	Warning Text	Description
1341	Engine Coolant Temp Probe Fault	The engine coolant temperature probe circuit is faulty. Engine coolant temperature is still provided by a separate engine coolant switch. The unit will continue to run. The condenser and radiator fans will run at maximum speed only, with no speed reduction available to reduce noise and fuel consumption. The unit must be inspected by an approved service dealer immediately after freight has been unloaded
1711	Liquid Line Temp Probe Fault	The liquid line temperature probe circuit is faulty. Automatic refrigerant charge evaluation and automatic leak detection is unavailable. The unit will continue to run. The unit must be inspected by an approved service dealer immediately after freight has been unloaded
1721	Evaporator Coil Temp Probe Fault	The evaporator coil temperature probe circuit is faulty. The unit will continue to run. The unit must be inspected by an approved service dealer immediately after freight has been unloaded
1731	Ambient Temp Probe Fault	The ambient temperature probe circuit is faulty. The control will be unable to simulate other sensors should they fail. The unit will continue to run. The unit must be inspected by an approved service dealer immediately after freight has been unloaded
2511	HP Switch Indicates High HP	The HP switch circuit indicates high HP. The unit will continue to run. The unit must be inspected by an approved service dealer immediately after freight has been unloaded
2611	LP Switch Indicates Low LP	The LP switch circuit indicates low LP. The unit will continue to run. The unit must be inspected by an approved service dealer immediately after freight has been unloaded
3111	Engine Coolant Temp High	The engine coolant temperature is higher than expected. Engine speed will be reduced. There is no danger to the engine, and it will continue to run. Inspect coolant level and condition after freight has been unloaded and unit has cooled. If the warning persists the unit must be inspected by an approved service dealer

WARNING CODES

Warning Code	Warning Text	Description
3121	Engine Coolant Level Low	The engine coolant level switch indicates the coolant reservoir is below its minimum level. The unit will continue to run. Coolant should be added as soon as possible to prevent an alarm condition, which will prevent the unit from running
3221	Engine Speed Unstable	Engine speed is unstable. This could indicate a problem of various components involved with running the engine stably. The unit will continue to run. If the warning persists the unit must be inspected by an approved service dealer to prevent an alarm condition as this warning could indicate preventable issues like fuel issues, filter issues etc.
3231	Engine Cranked Longer Than Expected	Engine cranked more than 2s longer than the recorded average crank time for this unit. This could indicate fuel delivery or air filter problems with the unit. The unit will continue to run. The unit should be inspected by an approved service dealer at earliest convenience
3431	Fuel Pressure Low	The pressure measured in the fuel line is below minimum specification. The unit will continue to run. The unit should be inspected by an approved service dealer at earliest convenience
4111	Condenser Fan/s Fault	One or more condenser fans are not drawing the appropriate current. One or more of the fans is probably not working.
4211	Evaporator Fan/s Fault	One or more evaporator fans are not drawing the appropriate current. One or more of the fans is probably not working.
4221	2nd Evaporator Fan/s Fault	One or more 2nd evaporator fans are not drawing the appropriate current. One or more of the fans is probably not working.
4321	Hotgas Coil Circuit Fault	During a self-test the hotgas coil circuit failed to draw current. The circuit is probably not working.
4341	Cap Con 1 Circuit Fault	During a self-test the capacity control 1 coil circuit failed to draw current. The circuit is probably not working.

WARNING CODES

Warning Code	Warning Text	Description
4351	Cap Con 2 Circuit Fault	During a self-test the capacity control 2 coil circuit failed to draw current. The circuit is probably not working.
4411	Fuel Pump Circuit Fault	During a self-test the fuel pump circuit failed to draw current. The circuit is probably not working.
4421	Air Heater	During a self-test the engine air heater circuit failed to draw current. The circuit is probably not working.
5011	Circuit Fault	While the engine is off the battery voltage is below 10.5V
5031	Battery Voltage Low	While the engine is running the battery voltage is below 12.0V
5401	No Pulses During Cranking	No rotation pulses have been received by the PLC while the PLC commanded the engine to crank.
5501	24V Voltage Alarm	While the engine is running, the 24V DC circuit dropped to below 16.0V.
5601	FSR Fuse Open Circuit	While the engine is running, the 24V DC circuit read above 32.4V.
6021	Compressor Over-Temp Switch Alarm	No fan amps were read on any of the fan banks. This indicates that the Hall Effect transducers are not receiving power. This is usually because the FSR fuse is open circuit.
6121	Compressor Discharge Temp High	Internal compressor temperature switch indicating the compressor is too hot for operation.
7101	Cooling Fault	The box temperature (RAT) is not decreasing as expected while the unit is in cooling mode.
7211	Heating Fault	The box temperature (RAT) is not increasing as expected while the unit is in heating mode.
7301	Temperature Regulation Fault	The box temperature (RAT) is not stabilizing at the set point value as expected while the unit is in regulating mode.
7401	HP Lower Than Expected	Condensing temperature is below ambient temperature while unit is in cooling mode for more than 5 minutes.
7421	Low Subcooling	Measured subcool temperature is below 0.5°C for more than 5 minutes, while the unit is in cooling mode.
7431	High Subcooling	Measured subcool temperature is above 12.0°C for more than 5 minutes, while the unit is in cooling mode.
7501	LP Lower Than Expected	LP was low enough to trigger an emergency defrost.

MAINTENANCE SCHEDULE – REQUIRED SERVICE

The recommended maintenance schedules are designed to give the maximum reliability and operation to your unit, thus ensuring trouble-free usage.

***Note:** The trailer refrigeration unit must be serviced at a maximum interval of 1 year, even if the diesel hours have not been achieved.

MT180 Maintenance Schedule													
Type of Service	1ST	A	B	A	B	A	C	A	B	A	B	A	C
MT180	500	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000	11000	12000

A SERVICE

- Replace Air filter.
- Clean fuel pump filter.
- Replace Primary fuel filter.
- Check and adjust all belts.
- Check Refrigerant level.
- Check defrost operation.

B SERVICE

- Carry out A service.
- Replace Secondary fuel filter.
- Fit gauges and check pressures
- Check battery terminals and fluid levels.
- Check compressor oil level.
- Replace PMG and Engine water pump belt.
- Check all bolts, screws and unit mounting bolts for tightness. Tighten as required.
- Check Control box wiring and components for tightness.

C SERVICE

- Carry out A and B service.
- Clean radiator and condenser
- Check and adjust engine valve (injectors) clearance accordingly.

WARRANTY

(This version of the above super cedes all previous written and/or implied policies issued by the company). Spheros South Africa (Pty) Ltd and its subsidiaries warrants each new unit for 12 months in respect of defective parts and workmanship effective from date of commissioning or 15 months from date of factory dispatch (whichever is the shorter) and spare parts for a period of 3 months from date of installation or 6 months from date of factory dispatch (whichever is shorter) providing that the unit or spare part is installed by an authorised Spheros south africa distributor or dealer. Spheros south africa's obligations under this warranty are limited to repairing or replacing, at its option, by an authorised Spheros south africa distributor or dealer any part or parts found to be defective during the warranty period.

1. EXCLUSIONS FROM THIS WARRANTY

a) Any part or parts of products becoming defective as a result of negligence, accident or other casualty.
b) Owner's failure to adhere to the Spheros South Africa recommended maintenance procedures to provide normal maintenance such inter alia, tightening of belts, cleaning coils, loss of refrigeration, drier replacement or improper voltage or electrical connections.
c) Equipment failure due to specification error, guidelines for which are issued by Spheros South Africa from time to time.
d) Operation in a manner contrary to Spheros SA printed or implied instructions.
e) Compressor engine mount adapter kits and their installation if not supplied and installed by Spheros South Africa or approved and authorized distributor or dealer.
f) Refrigerant leaks (other than caused by component failure) which occur in excess of 45 days after date of commissioning the equipment.
g) Failure of equipment, which has been modified without specific Spheros South Africa approval.
h) Wearing parts such as belts, filters, driers, fuses, which fail after 90 days from commissioning.
i) All labour time outside of normal working hours.
j) All traveling time and accommodation expenses.
k) Any consequential costs in contract or tort including payment of any damages of whatever nature, whether general or special, which may be sustained by the purchaser in consequence of any defect of whatever nature as may be found to exist in, relation to, the equipment or any portion thereof.

WARRANTY

2. CONDITIONS OF WARRANTY

a) Spheros South Africa neither assumes nor authorizes any person to assume for it, any obligation or warranty other than stated in this warranty.

b) Spheros South Africa reserves the right to make changes in design or improvements of its products or parts thereof without obligation to make or install such changes or improvements in or upon products covered in this warranty.

c) Spheros South Africa approved dealers does not warrant the workmanship of the installer, other than Spheros South Africa and will not bear any cost due to faulty or incorrect installation or shipping damage or product loss.

d) Spheros South Africa will not be liable for loss of time, labour, equipment rental or other expense while products are out of service.

First service validates full warranty (50 hr).

This is the sole and only warranty supplied by us and no other condition of warranty will be recognised unless it is an official written document supplied by the said company.

SERVICE

(REFER TO MAINTENANCE SCHEDULE) – SEE PAGE 36

All maintenance should be performed by an authorised Spheros South Africa Dealer (as detailed in this book) and at the stipulated hours or time intervals.

1ST SERVICE VALIDATES WARRANTY WITHIN 1 MONTH OF INSTALLATION

KM READING

DATE

DEALERS SIGNATURE/STAMP

SERVICE A

KM READING

DATE

DEALERS SIGNATURE/STAMP

SERVICE B

KM READING

DATE

DEALERS SIGNATURE/STAMP

SERVICE A

KM READING

DATE

DEALERS SIGNATURE/STAMP

SERVICE B

KM READING

DATE

DEALERS SIGNATURE/STAMP

SERVICE A

KM READING

DATE

DEALERS SIGNATURE/STAMP

SERVICE

(REFER TO MAINTENANCE SCHEDULE) – SEE PAGE 36

SERVICE C

KM READING

DATE

DEALERS SIGNATURE/STAMP

SERVICE A

KM READING

DATE

DEALERS SIGNATURE/STAMP

SERVICE B

KM READING

DATE

DEALERS SIGNATURE/STAMP

SERVICE A

KM READING

DATE

DEALERS SIGNATURE/STAMP

SERVICE B

KM READING

DATE

DEALERS SIGNATURE/STAMP

SERVICE A

KM READING

DATE

DEALERS SIGNATURE/STAMP

SERVICE

(REFER TO MAINTENANCE SCHEDULE) – SEE PAGE 36

SERVICE C

KM READING

DATE

DEALERS SIGNATURE/STAMP

DEALER NETWORK

SPHEROS SA APPROVED SERVICE DEALER NETWORK

COMPANY	AREA	CONTACT
Cool Perfection	Bloemfontein	Geoff Stannard
Zero Temp (Updealers)	Botswana - FrancisTown	Vaughan Granville
Airtron	Botswana - Gaborone	Jeremy Babbage
Trans Fridge Botswana	Botswana - Gaborone	Louisa Barnard
E.R.T.S	Cape - George	Peter Carney
G.R.A	Cape - George	Danie Pio
Cool Tranz	Cape Town	Des Bradford
Cool Tranz	Cape Town	Shane Bradford
Maxicool	Cape Town	Ian Gilmour
Cool Perfection	Durban	Geoff Stannard
Fridgetranz	Durban	Christo Brown
Transfrig Border E.L.	East London	Adrian v.d. Merwe
Spheros	Gauteng - Linbro Park	Kobus van Rensburg
Spheros	Gauteng - Linbro Park	Kent Donaldson
RTS	Gauteng - Midrand	Daphne / Bonny
AC & R Refrigeration	Gauteng - Pretoria	Peter Griezel
Refsatrans	Gauteng - Vaal Triangle	Walther Ravyse
Cool Link Technics Ltd	Kenya	James Kamande
Specialised Fibre Glass	Kenya	Ross Field
Instant Service Repairs	Klerksdorp	Ruan
Topax Workshop	Klerksdorp	Jose Da Silva
Walvisbay Refrigeration	Namibia - Walvisbay	Allester Dronia
Cool Coenie Ref	Namibia - Windhoek	Conrad Stols
Cooltheron	Nelspruit	Eben Theron
Shivers cc	Polokwane	P.J Weir
Transfrig Eastern Cape (Queentek)	Port Elizabeth	Karel Wolmarans
Mother Cool	Swaziland	Ean Sauerman
SS Stander Herstelwerke	Upington	Fanie Stander
Refair	Zimbabwe - Bulawayo	Clive Hill
Cold Control	Zimbabwe - Harare	Theo da Fonseca

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