SPHEROS

TRANSPORT REFRIGERATION UNITS FOR MEDIUM AND LARGE RIGID TRUCKS

MT DIESEL ELECTRIC
220i/310i/460i/660i

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:

SPHEROS SOUTH AFRICA OPERATOR'S MANUAL

This operator's manual is for the MTi range of Diesel Electric units.

The manual includes service intervals, safety information, trouble shooting and other information to assist in the operation and maintenance of the equipment.

Following the correct maintenance program will avoid costly down time. It is essential that during the warranty or contract period (should there be a service contract in place) that the unit is serviced and maintained by an authorised Spheros South Africa dealer only.

Spheros South Africa products are subject to constant improvement. Therefore specifications, design, operation or equipment may change without prior notice.

Original edition

(6th English edition)
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Should you require further information, do not hesitate to contact your nearest Spheros South Africa dealer.

CONTENTS

SAFETY GUIDE

INSTALLATION

When installing or removing the unit correct lifting equipment should always be used. Do not stand beneath a unit that is being lifted.

SERVICE AND MAINTENANCE

The unit has many moving parts. Covers and grills have been fitted with customer safety in mind. Always stop the unit before carrying out service and maintenance. This includes pre-trip inspections. Care should be taken with parts such as exhaust mufflers, tail pipes and radiators as they may become extremely hot. Never remove the cap from a hot radiator as radiator coolant is under pressure and serious injury can occur.

BATTERIES

When working with batteries protective gloves should be worn. Batteries contain acid and if spilt on the skin can cause severe burns. Acid splashes on the skin should be washed off immediately with water. Care should be exercised when using spanners to avoid shorting the terminals. Failure to do so could result in damage to the battery and the unit's electrical system.

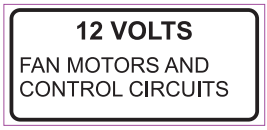
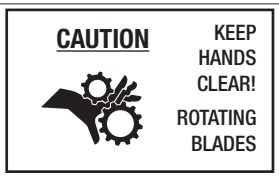
REFRIGERANTS

It is recommended, in line with current legislation for the refrigeration industry, only persons who have completed the Safe Handling of Refrigerants course and are registered with ACRICSA (The Governing Body), carry out services on your refrigeration system. Contact your nearest Spheros South Africa Dealer.

ELECTRICAL

High voltages are used for the electric motor standby drive. Inside the control box there are a combination of low voltage DC for the control circuits and high voltage AC components for driving the electric motor. It is therefore recommended that only personnel who have had the correct factory training carry out service and repairs on the electrical system. Contact your nearest Spheros South Africa Dealer.

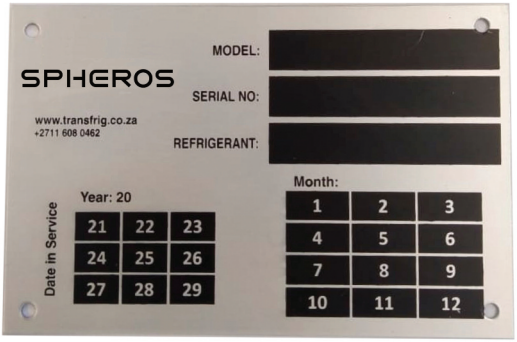
IMPORTANT SYMBOLS ON SPHEROS SA UNITS

	Voltage indication.
	Warning sign, electric shock hazard.
	Type of refrigerant used
	Warning sign, moving machinery hazard
	Type of compressor oil to be used
	Direction of fan rotation
	Oil level indication

UNIT IDENTIFICATION

Each unit is identified with a nameplate containing the relevant serial number.

The serial plate contains the year and month the unit was manufactured.



Position of plate on unit under cover

The serial number and model type must always be used in the event of warranty claims and spares purchase.

MT Diesel Electric 220i/310i/460i/660i

FEATURES

Application

The refrigeration system will refrigerate insulated bodies as tabulated.

Models	Approximate maximum body lengths @ given box temperatures		
	0°c	-18°c	-25°c
MT220i	5,5m	5,0m	4,5m
MT310i	7,5m	6,3m	5,6m
MT460i	9m	8m	7m
MT660i	9,2m	9,2m	9,2m

Note: In order to ensure the correct application, ambient temperature, body insulation and number of door openings must be taken into consideration. Please consult your Spheros South Africa dealer before final selection.

General design concept

The frame is manufactured from epoxy powder coated stainless steel and the evaporator from stainless steel and aluminium. Covers are made from UV resistant GRP.

Clutch

ISO 9001 Centrifugal, 3 claw.

Air flow

A constant airflow is provided by electric evaporator fans.

Defrost

Automatic defrost is initiated by means of pre set timer. A manual defrost facility is also provided.

Simple operations

The required temperature is set on the thermostat. Initiating refrigeration and changing from diesel to electric drive is all controlled from the in-cab control panel.

Ozone friendly refrigerant

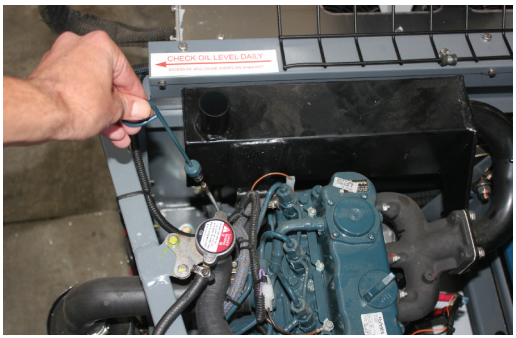
Zero ODP R404A.

			MT 220i	MT 310i	MT 460i	MT 660i
Cooling Capacity @30°C ambient R404A	**Diesel**	0°C	3600	5000	7900	10500
		-20°C	2100	3000	4500	6300
	Electric	0°C	2700	3700	5900	7800
		-20°C	2000	2300	3400	4700
Air Volume Flow (m^3/h)			2000	3000	3300	3900
Aperture Dimensions (mm)	**Width**		780	1250	1250	1420
	Height		325	325	350	350
Weight (kg)			306	346	390	564
Compressor	**Type**		FKX30/235	FKX30/235	FKX30/325	FKX40/470
	Cylinders		2	2	2	4
	Displacement (cm^3)		235	235	325	470
Diesel Engine	**Cylinders**		2	2	3	3
	Displacement (cm^3)		482	482	722	1005
Electric Motor			**50 Hz/60 Hz**	**50 Hz/60 Hz**	**50 Hz/60 Hz**	**50 Hz/60 Hz**
	Power (kW)	380V 3Ph	3	4	5,5	7,5
		220V 3Ph				
	Current consumption (A)	380V 3Ph	6,6	8,5	10,7	16,1
		220V 3Ph	10,9	13,5	21	26

TECHNICAL SPECIFICATIONS

ITEM	MT220i	MT310i	MT460i	MT660i
Refrigeration Settings				
HP Cut Out	32 bar (464 psi)	32 bar (464 psi)	32 bar (464 psi)	32 bar (464 psi)
HP Cut In	23 bar (333 psi)	23 bar (333 psi)	23 bar (333 psi)	23 bar (333 psi)
LP Cut Out	0 bar (0 psi)	0 bar (0 psi)	0 bar (0 psi)	0 bar (0 psi)
LP Cut In	1,38 bar (20 psi)	1,38 bar (20 psi)	1,38 bar (20 psi)	1,38 bar (20 psi)
EEV	1,7 bar (25 psi)	1,7 bar (25 psi)	1,9 bar (28 psi)	2,1 bar (30 psi)
Refrigerant Type	R404A	R404A	R404A	R404A
Refrigerant Qty	1,8kg	2,0kg	3,0kg	6kg
Diesel Engine				
Engine Model	Z482	Z482	D722	D1005
Engine Speed	2300 rpm	2300 rpm	2300 rpm	2400 rpm
Engine Oil (SAE)	15W40	15W40	15W40	15W40
Engine Oil Qty	2 litre	2 litre	3 litre	9 litre
Coolant Capacity	2,5 litre	2,5 litre	3 litre	6 litre
Antifreeze concentration	50%	50%	50%	50%
Compressor				
Compressor Type	Bock	Bock	Bock	Bock
Compressor Model	FKX30/235	FKX30/235	FKX30/325	FKX40/470
POE68	2 litre	2 litre	2 litre	2 litre
Electric Motor				
kW Rating	3	4	5,5	7,5
O/Load Setting (Max)	6,6 amps	8,5 amps	10,7 amps	16,1 amps

PRE TRIP INSPECTION



This inspection should be carried out prior to loading. If the following is strictly adhered to, this should save costly downtime.

ENGINE OIL

Remove the dipstick and wipe clean, re insert and then remove again. The reading should be somewhere between the full mark and the low mark. If low add oil accordingly.

WATER LEVEL

Remove radiator cap slowly to release pressure. Check level and top up (if necessary) with 50% Demineralized water and 50% anti freeze mixture. Do not top up with water only as this will dilute anti freeze protection strength.

The following could occur should anti freeze protection strength be diluted:

- Internal corrosion of engine block and cylinder head
- During winter months freezing water expands and could cause cracks to engine block and cylinder head.

FUEL

Check fuel tank level is sufficient for the duration of the trip.

PRE-COOLING THE INSULATED BODY

- Prior to loading the truck body, start the unit and set the temperature controller to the desired set point (the temperature at which the product must be transported). This ensures that the empty box can achieve the correct temperature for the product being loaded.

OPERATING THE UNIT

All Spheros South Africa diesel electric units are quipped with in-cab controls. This allows the driver to operate the unit from the driver's seat and to be able to monitor temperature on the load at all times.

DIESEL START UP (3-PHASE NOT CONNECTED)

Available Functions:

1. Long Haul: with switch on "long-haul" position.
   Unit will run for a minimum of 20mins to ensure unit battery is fully **charged** before it switches off on set point temperature, if the set point temperature is reached for the initial 20 mins, the unit will fluctuate around the set point value until the 20min timer runs out.

   When defrost is called for, unit will automatically start up, run through its defrost cycle, re-cool the box to its set point temperature, and run for a minimum of 20mins once again to ensure that the unit's battery is fully charged.

   When unit is on set point temperature, another 20min delay time is executed before the unit re starts. This is to allow the starter to not overheat with often start and stop cycles.

Note: The long-haul function is not applicable to electric operation i.e. when the 3-phase plug is connected, the unit will run as per normal in electric operation.

2. ON
   The diesel engine will run constantly even after reaching the set point temperature, the unit will then switch between defrost and cool around the set point temperature.

OPERATING THE UNIT CONTINUED

ELECTRIC START UP (3-PHASE CONNECTED)

The unit will cool until set point temperature, provided that all 3 phases are present and electric motor operates within its current limit range, once on the set temperature, the unit will then switch off and only switch back on after a programmed set delay time of 5 minutes has elapsed irrespective on the box temperature.

Note: With 3 phase connected, the unit is set by default to run on electric.

CHANGING SET POINT

Press and hold the **SET** button and hold for more than 2 seconds to change the set point value.

The value of the set point will be displayed and the ^{0}C will start flashing.
To change the set point value press the **up ↑** or the **down ↓** within 10 seconds.

To store the new set point value push the **SET** button again.

To lock the keyboard, press the **up ↑** and **down ↓** buttons together for more than 3 seconds. The **POF** message will be displayed and the keyboard will be locked. At this point it will be possible only to see the set point value if up or down buttons are depressed.

To unlock the keyboard, press the **up ↑** and **down ↓** buttons together for more than 3 seconds. The **PON** message will be displayed and the keyboard will be unlocked.

PLC MTi SERIES

GENERAL

Introduction:

The PLC is a microprocessor controller which monitors the inputs (1) and then controls the outputs (0). It contains many functions which include:

- Digital logic (OR/AND/NAND/NOT/NOR), Timer, Counters, Pulse Counters, Hour Meters, ADC, digital out, relay out, Display, Analogue Functions

DISPLAY

Normal Running Electric:

The front screen has a rotating display i.e. HP, LP,UDC,UAC,Pb1,PB,dHrS and ACP.
If cooling is required but the motor is in the anti short cycle mode. (The contactor is off for a minimum of 5 min)

Fault Electric:

The following faults could be displayed:

- HP – High pressure trip point exceeded
- LP – Low pressure trip point exceeded
- Phase – Phase rotation incorrect or a phase is missing. (The Phase control relay (PHR) light is off). O/L – The overload relay has tripped

To reset a fault, switch off the controller wait 5 seconds and then switch on again. If the fault has cleared it will be reset. Alternatively, hold button "B" for 5 seconds.

Normal Running Diesel:

The front screen has a rotating display i.e. HP, LP,UDC,UAC,Pb1,PB,dHrS and ACP.

Fault Running Diesel:

The following faults could be displayed:

- HP – High pressure trip point exceeded
- LP – Low pressure trip point exceeded
- Oil – Oil pressure low (inhibits for 20 seconds at start)
- Water – Water switch closed the engine has overheated
- Speed – Low speed for over 40 seconds

To reset, switch off unit for 5 seconds, then restart. If the fault has cleared it will reset. Alternatively, hold button "B" for 5 seconds.

UNDERSTANDING THE IPRO

Analogue input: (Pb1 – Pb6)
This input point accepts varying voltages and relates it into digital form for PLC processing

Digital input: (DI1 – DI11)
This input point accepts varying voltages and relates it into digital form for PLC processing

Analogue Output: (Out1 – Out4)
This type of output is capable of producing a varying or fixed output voltage of between 0 – 10VDC

Digital Output, sometimes referred to as relay output: (RL1 – RL8)
Example: for the Dixel Ipro, power is supplied to the common pins (pins 40, 41, 47, 48), when the relay outputs are required, the output will reflect same voltage supplied to the common pins. (See next image: Ipro Electric Layout, for pin locations)

Transducer:
A device capable of relating real time occurrences into a variable voltage signal. Example: LP Transducer, which is able to relate suction pressure into a variable output voltage.

Switch:
A device which relates real time occurrences to either "on" or "off".
Example: HP switch, which has a normally closed condition and an open "tripped" point when pressure in the system is exceeded.

Phase detection Module:
This module is responsible for selecting either the clock or anti clock contactor to allow the condenser fan to always pull air inwards from the front or the unit.

UNDERSTANDING THE IPRO CONTINUED

Solid state relay:

This can be seen as a normal relay. The only difference is that the trigger does not require as much current as the traditional electro mechanical relay. Similarities shown below.

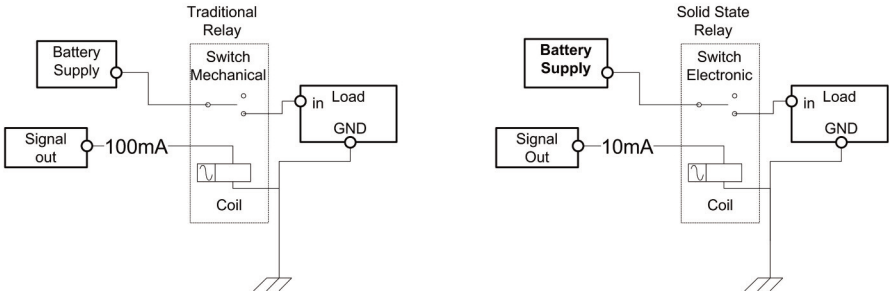


Figure 1: Traditional Relay VS Solid state Relay

As can be seen in the above image, the traditional relay (Left) requires 100mA to activate the coil for the mechanical switch. The solid state relay (Right) requires 10mA to activate its "Coil".

Note: Spheros South Africa utilises a single board with 2 solid state relays. Electrical Equivalent image shown below:

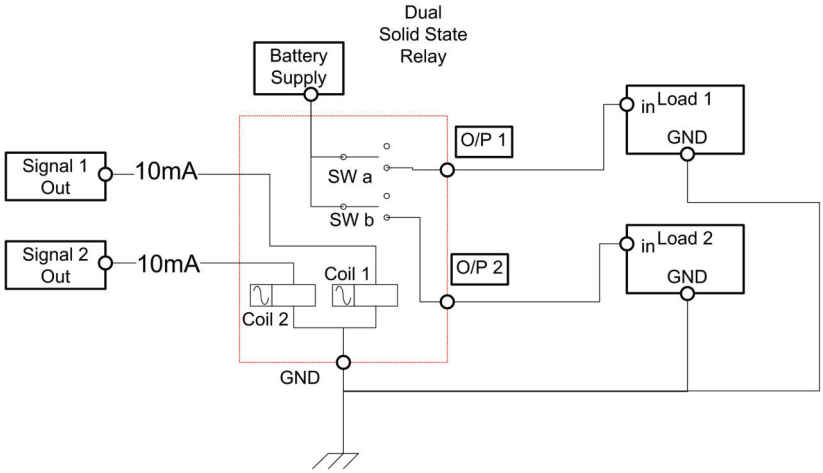


Figure 2: Dual Solid State Relay Equivalent circuit

UNDERSTANDING THE IPRO CONTINUED

Physical Relay:

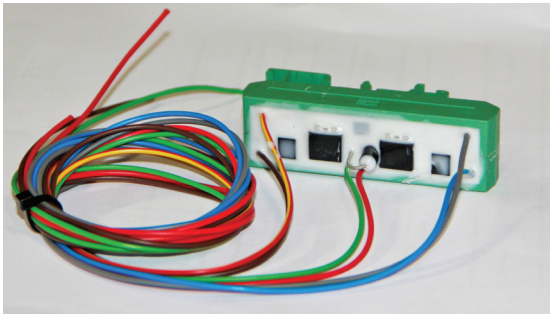


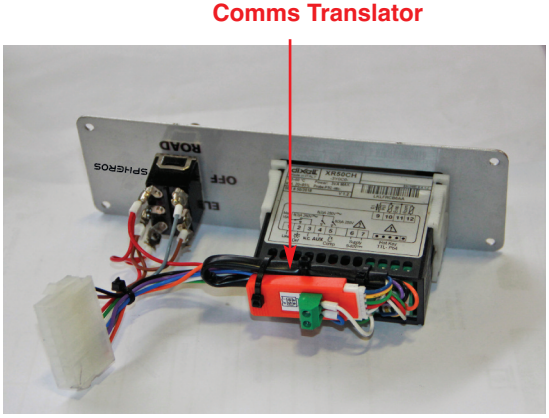
Figure 3: Solid State Relay Module

RS 458 communications port

This port is used to communicate between the Ipro PLC and the XR50 display/control incab thermostat via 2 core cables. Information such as probe temperatures, cool, defrost commands are relayed to the PLC, reducing the amount of cables needed to the incab display. This is particularly useful for when an electronic expansion valve or additional thermostat is used. These additions would simply be given addresses and be connected in series to each other.

When using an XR50 thermostat, a RS458 translator needs to be present as shown in the image below.

Figure 4: Thermostat with Translator



Example: Both Probes (box and evaporator) are connected directly to the XR50 thermostat and relayed through the comms port to the PLC. Hence, probe temps can be read on the PLC display.

UNDERSTANDING THE IPRO CONTINUED

PLC Electrical Layout:

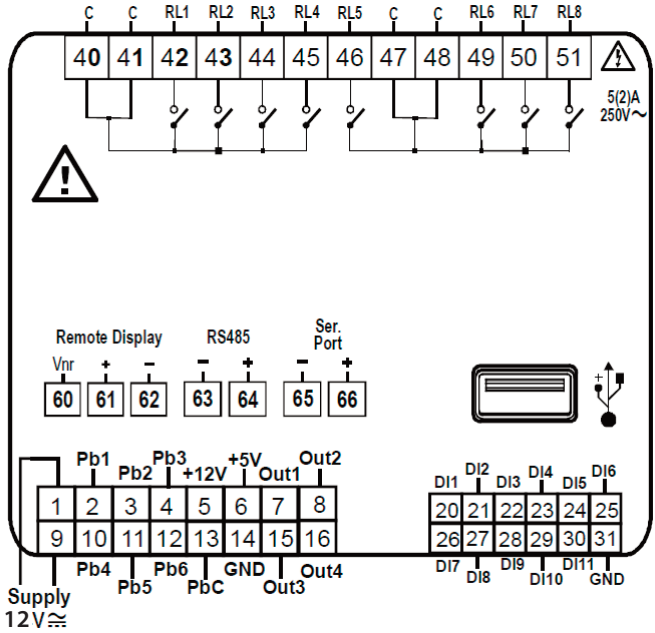


Figure 5: Ipro Electric Layout

Note: In the above image, PB1 – PB6 are able to read probes directly, however in the MT units these pins are configured to be analogue inputs.

This PLC is supplied with 12VDC ONLY. Not 24V.

UNDERSTANDING THE IPRO CONTINUED

IPRO START UP PROCEDURE

The Dixel Ipro has a normal operating start-up condition when switching on the PLC's lights come on (Left in below image) then fade away (Right in below image). These LED's are marked as "LED PWR ON" and "LED 1 (Heart beat)". THIS IS NORMAL. If a faulty PLC is suspected, it would show on "LED 1". This LED will begin to flicker after all the LED's all turn off. If this LED stays off or permanently on or is slightly dim while the PLC is powered, the PLC is then faulty and will not process anything.

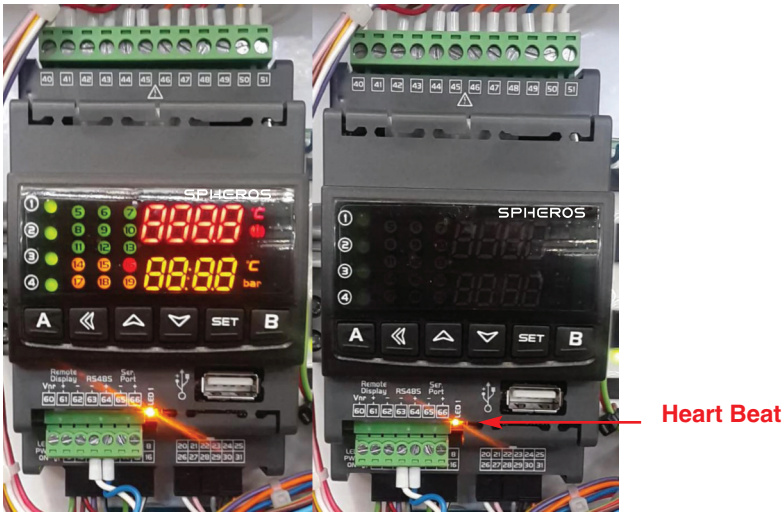


Figure 6: Normal PLC start up Procedure

As shown above, the PLC has illuminating lights as indications of either an active input or active output. Note the numbering of these lights do not correspond to the input numbering. These lights are to be used for fault finding.

UNDERSTANDING THE IPRO CONTINUED

Operation: Electric

For the electric motor to run, the lights on the following image should reflect.

Figure 7: PLC State before electric run

LED #	FUNCTION
1	ON
2	Cool
5	O/L
6	Water
8	LP/HP
9	Phase
10	VAC
11	Start

Note: The alternator (LED#16) and condenser fans (LED#14) are not active in this image.

To understand electric operation, the following analogue output modules in the control box needs to be understood.

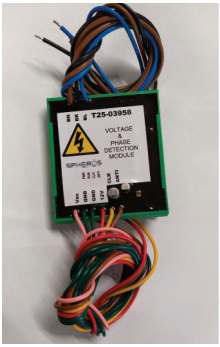
Voltage Detection Module:

The output analogue voltage from this module for a healthy 380VAC on all 3 incoming lines should equal 4.2VDC. See following image

Phase Detection Module:

The voltage at the clock output wire for a healthy module needs to be between 11 and 12VDC.

Figure 8: 3 Phase/voltage Detection Modules



Note: Only one of the phase rotation wires are connected to the PLC. The assumption being, if the Voltage detection module is active, the PLC only needs to register clock rotation. If clock rotation is not present and voltage detection module active, the "anti-clock" contactor will be brought in.

UNDERSTANDING THE IPRO CONTINUED

Motor Overload:
With the new Ipro PLC, electric motor current is monitored via current transformer as shown in the image below. This is known as a current sensor.
The PLC would then have a fixed "trip" point when the electric motor current is exceeded.

Current Sensor:
This module has an analogue output with normal voltage output ranging between 4-8V. this voltage relates the current being drawn by the electric motor, generating the 4-8VDC. See following image.

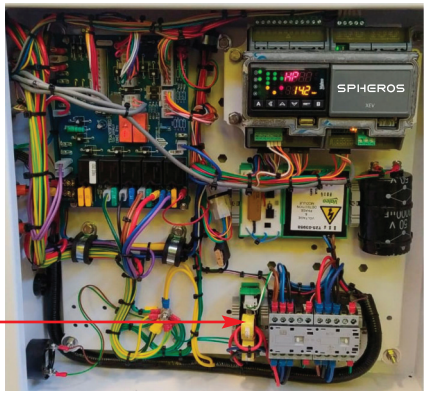


Figure 9: Electric control

For electric start up the following conditions need to be met:

- Voltage Detection Module = active (LED#10)
- Oil switch = off (LED#7)

If the oil switch is active while trying to run the unit in electric, the PLC will not bring in the electric motor as it assumes the diesel engine is running in the case of a faulty stop solenoid and the diesel engine is still running.
This could also be a problem when the oil switch is faulty and remains permanently open.

I.e. A Healthy oil switch is closed with the diesel engine not running, and opens when the diesel engine is running.

UNDERSTANDING THE IPRO CONTINUED

Operation: Diesel

For the diesel engine to run, the lights on the following image should reflect.

LED #	FUNCTION
1	ON
2	Cool
5	O/L
6	Water
8	LP/HP
11	Start
13	Fuel
15	DEF

Figure 10: PLC State before Cranking

Note: The alternator (LED#16) and condenser fans (LED#14) are not active in the above image.

For the diesel engine to start, the oil switch (LED#7 on PLC) needs to be off. This is because the oil switch opens when the engine is running normally. If the LED is active before start up, the PLC will follow the start-up procedure BUT will refuse to crank.

The start-up procedure is as follows

- Liquid line = active
- Defrost solenoid = active for 2 seconds (equalizes pressure in suction and discharge lines)
- Glow = active for 8 seconds
- Crank =active 8 seconds or if the oil switch opens before the time.

UNDERSTANDING THE IPRO CONTINUED

Stop Solenoid control:
In an effort to reduce stop solenoid failures in the field, the single wire stop solenoid has 2 conditions. Initial pull, and hold condition.

This control in the hold state utilizes 1 solid state relay in series with a 1.8Ω 50W resistor, in series to the stop solenoid. This resistor is also known as the "eco resistor" Image shown below:

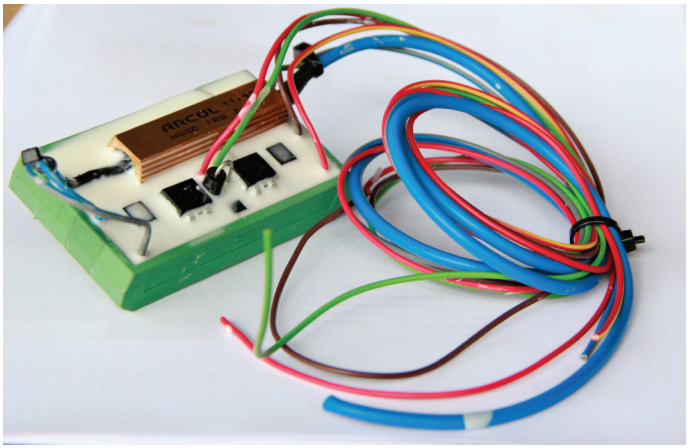


Figure 11: Solid State Relay Module with Eco Resistor

Initial pull:
The stop solenoid has the full 12V @ 11A across it for 2 seconds.

Hold:
The solid state relay is active for 8 seconds after the initial pull, to allow the voltage at the stop solenoid to drop to 6V @ 6.5A

Note: : If a 50W resistor is not present in the solid state relay module, the unit does not have this control.

LOADING

Spheros South Africa Refrigeration units are designed to maintain and not reduce the temperature of the product. It is therefore imperative that the Driver/Operator checks the product is at the correct temperature at the time of loading. Care should be taken when loading the truck that airflow around the product is continuous, loading on pallets is recommended. Air is blown out of the evaporator and must be able to circulate through the load and return along the floor of the body in a continuous cycle. Loading the product too high and blocking the return air ducts, may result in short cycling. This often freezes the top row of product.

TRUCK BODY

Prior to loading inspect the inside and outside of the insulation skin for delamination and holes. Inspect door seals and door closing mechanisms. Doors that will not close properly and punctures of the insulation material will affect the refrigeration unit's ability to maintain correct temperature. Check that loading materials such as cardboard and shrink-wrapping have not entered the evaporator, as this will cause damage to fan motors and fan blades.

RECOMMENDED TEMPERATURE GUIDE

Below is a guide to recommended temperature settings for a few products. These are recommendations only. For further information on set point refer to customer/supplier.

PRODUCT	SET-POINT RANGE
Ice Cream	-25°C
Frozen Meats Vegetables and Seafood	-18° to -20°C
Dairy Products	+2° to +4°C
Fresh Meats	+2° to +5°C
Fresh Fruits and vegetables	+4° to +8°C

Door opening should be kept to a minimum, each time the doors are opened warm air and moisture enters the body. It is recommended during delivery cycles that the unit should be stopped whilst unloading.

TROUBLE SHOOTING

Spheros South Africa strives to achieve the highest possible standards. Should problems arise with your unit, below is a general guide to help the operator carry out some basic checks prior to calling an Authorised Dealer for assistance.

PROBLEM	CAUSE	REMEDY
Engine will not turn over	Flat battery	Charge battery
	Loose battery connections	Tighten loose connections
	Fuse blown	Replace blow fuses
Engine turns over but will not start again	No fuel	Fill fuel tank
	Air in fuel system	Bleed fuel system
	Fuel shut off solenoid sticking	Adjust sticking solenoid
	Fuse blown	Replace blown fuse
Engine starts and then cuts out	Low oil or water levels	Top up as necessary
	Low fuel level	Fill up as necessary
	Fuse blown	Replace blown fuses
	Air in fuel system	Bleed fuel system
Unit runs but doesn't cool down	Evaporator fans not working	Check fuses
	Low gas	Call agent for support
	Evaporator iced up	Manual defrost
	Belts slipping	Adjust

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 fridge must be serviced at a maximum interval of 4 months, even if the diesel hours have not been achieved.

***Note:** All MT services at 500 hour intervals.

***Note:** Free Post-delivery inspection (PDI) to be conducted by an accredited Spheros South Africa agent within 50 diesel hours to validate the warranty.

MT 220i / 310i / 460i / 660i													
Type of Service	**PDI**	**A**	**A**	**B**	**A**	**A**	**B**	**A**	**A**	**C**	**A**	**A**	**B**
MT220i MT310i	50	500	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500	6000
MT460i	50	500	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500	6000
MT660i	50	500	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500	6000
Type of Service	**A**	**A**	**B**	**A**	**A**	**C**	**A**	**A**	**B**	**A**	**A**	**B**	**A**
MT220i MT310i	6500	7000	7500	8000	8500	9000	9500	10000	10500	11000	11500	12000	12500
MT460i	6500	7000	7500	8000	8500	9000	9500	10000	10500	11000	11500	12000	12500
MT660i	6500	7000	7500	8000	8500	9000	9500	10000	10500	11000	11500	12000	12500

SERVICE SCHEDULE

A SERVICE

- Drain engine oil, replace oil filter – **See page 6**
- Oil capacity MT220i MT310i – 2 litres / MT460i - 3 litres
- Check engine cooling system
- Clean air filter cartridge
- Clean fuel pump filter
- Check and adjust all belts
- Check refrigerant level
- Check defrost operation
- Check engine speed under load – **See page 5**

B SERVICE

- Carry out A service
- Replace diesel fuel filter
- Replace air filter cartridge
- Fit gauges and check pressures
- Check battery terminals and fluid levels
- Check compressor oil level
- Check alternator brushes
- Check engine thermostat for correction operation
- Check defrost
    1. Check timer setting and function
    2. Check correct operation of hot gas valve
    3. Fans Stop
    4. Defrost stops automatically
    5. Water drains correctly from evaporator
- Check and adjust engine valve clearance
- Replace belts as necessary. Check idler pulley bearings
- Check all bolts, screws and unit mounting bolts for tightness. Tighten as required
- Check control box wiring and components for tightness

SERVICE SCHEDULE

C SERVICE

- Carry out A & B service
- Clean radiator and condenser
- Replace alternator regulator and brush pack assembly
- Check alternator bearings
- Clean and adjust fuel injectors (140 kg/m^2)
- Drain and flush anti-freeze in diesel engine, refill with 50/50 solution – **See page 5**

MT Diesel Electric 220i/310i/460i/660i

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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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 Valeo distributor or dealer. Valeo's obligations under this warranty are limited to repairing or replacing, at its option, by an authorised Valeo 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.

Free Post-delivery inspection (PDI) to be conducted by an accredited Spheros South Africa agent within 50 diesel hours to validate the warranty.

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 21

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.

PDI SERVICE VALIDATES WARRANTY WITHIN 1 MONTH OF INSTALLATION KM READING DATE DEALERS SIGNATURE/STAMP	SERVICE A 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 A KM READING DATE DEALERS SIGNATURE/STAMP

SERVICE

(REFER TO MAINTENANCE SCHEDULE) – SEE PAGE 21

SERVICE B

KM READING

DATE

DEALERS SIGNATURE/STAMP

SERVICE A

KM READING

DATE

DEALERS SIGNATURE/STAMP

SERVICE A

KM READING

DATE

DEALERS SIGNATURE/STAMP

SERVICE C

KM READING

DATE

DEALERS SIGNATURE/STAMP

SERVICE A

KM READING

DATE

DEALERS SIGNATURE/STAMP

SERVICE A

KM READING

DATE

DEALERS SIGNATURE/STAMP

SERVICE

(REFER TO MAINTENANCE SCHEDULE) – SEE PAGE 21

SERVICE B

KM READING

DATE

DEALERS SIGNATURE/STAMP

SERVICE A

KM READING

DATE

DEALERS SIGNATURE/STAMP

SERVICE A

KM READING

DATE

DEALERS SIGNATURE/STAMP

SERVICE B

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DEALERS SIGNATURE/STAMP

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SERVICE A

KM READING

DATE

DEALERS SIGNATURE/STAMP

SERVICE

(REFER TO MAINTENANCE SCHEDULE) – SEE PAGE 21

SERVICE C

KM READING

DATE

DEALERS SIGNATURE/STAMP

SERVICE A

KM READING

DATE

DEALERS SIGNATURE/STAMP

SERVICE A

KM READING

DATE

DEALERS SIGNATURE/STAMP

SERVICE B

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SERVICE A

KM READING

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DEALERS SIGNATURE/STAMP

SERVICE A

KM READING

DATE

DEALERS SIGNATURE/STAMP

SERVICE

(REFER TO MAINTENANCE SCHEDULE) – SEE PAGE 21

SERVICE B	SERVICE A
KM READING	KM READING
DATE	DATE
DEALERS SIGNATURE/STAMP	DEALERS SIGNATURE/STAMP

NOTES

NOTES

NOTES

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