OSF

active harmonics
conditioner

installation and
user manual

To the user

We would like to thank you for choosing the **OSF** active harmonics conditioner and welcome you to the ever increasing world-wide family of satisfied FRAKO product users.
This manual has been written to provide you with all the information necessary to install and operate your **OSF** active harmonics conditioner.

We remain at your entire disposal should you require any further details.

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advice for safety

Danger: dangerous voltages are present inside the conditioner. Any intervention requiring the door or protection panels to be opened must be carried out by qualified personnel;
■ the conditioner must be earthed;
■ do not place the conditioner near liquid or in an excessively damp environment;
■ do not obstruct the air vents;
■ do not place the conditioner in direct sunlight or near a source of heat;
■ if the conditioner in stored before use, it must be kept in a dry place. Storage temperature: between -20°C and +45 °C;
■ do not store horizontally;
■ dispose of packing waste in compliance with legal provisions in force.

contents

Installation of the **OSF** active harmonics conditioner, monitoring of correct operation and certain repairs must be carried out by qualified personnel trained to deal with electrical hazards. Other operations may be carried out by any other persons with the help of this manual.

All **OSF** range products are protected by patents; they implement original technology which cannot be used by any competitor of FRAKO GmbH.

identification
standards

identification label

Check that your utility supply is compatible with the characteristics given on the identification label placed inside the door of the **OSF** active harmonics conditioner.

standards

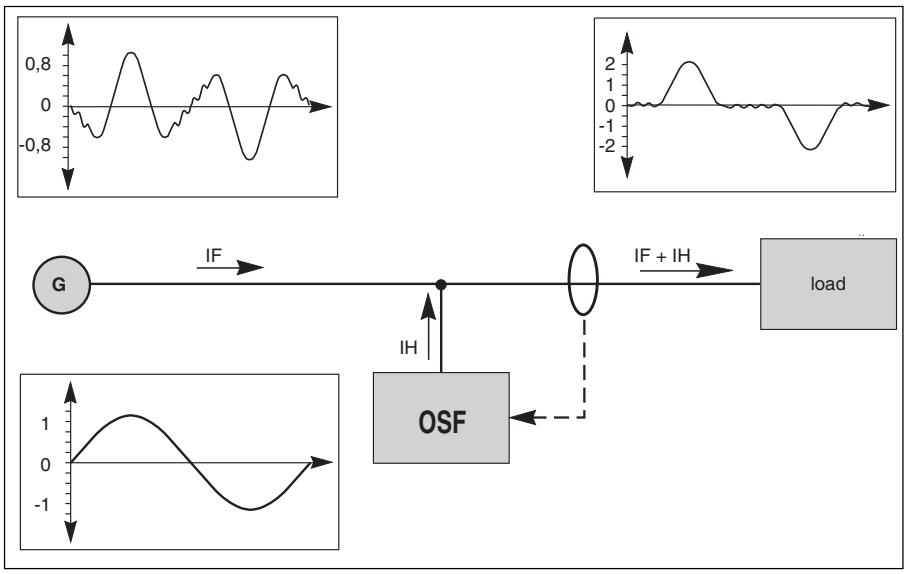
■ the **OSF** active harmonics conditioner complies with the main international standards in force for this type of equipment and notably concerning:
□ design
IEC 146,
□ construction and safety:
EN 50091-1,
□ noise:
ISO 3746,
□ protection:
IEC 529, NFC 20010,
□ electromagnetic compatibility:
EN 55011 class A,
□ susceptibility:
IEC 1000-4-1
IEC 1000-4-2 level 3
IEC 1000-4-3 level 3
IEC 1000-4-4 level 4
IEC 1000-4-5 level 4
IEC 1000-4-6 level 3,
□ quality organisation:
ISO 9001,
□ EC marking.

improvements offered by OSF

The **OSF** active harmonics conditioner allows:
■ current distortion to be reduced and problems due to harmonics to be avoided, e.g.:
□ unintentional tripping of protections owing to the value of current in the neutral,
□ cable heating, notably in the neutral,
□ heating of generators (transformers, generator sets, inverters, etc.),
□ standards on harmonics consumed on the utility power not being respected;
■ voltage distortion to be improved as well as device operating problems due to over heavily disturbed supply voltages;
■ an installation's characteristics to be improved so that devices can operate in conditions specified by the manufacturer;
■ reactive energy to be compensated, when this type of operation is possible, and the cosine to be converted to a value higher than or equal to 0.94 as recommended by electricity utilities.

operating principle

The current consumed by a non-linear load (e.g. a computer system) is composed of a sinusoidal current IF, which is a fundamental current at the utility power frequency, and a harmonic current IH made up of currents having frequencies that are multiples of the network frequency.
The **OSF** conditioner continuously generates a current equal to IH so that the utility power current only has to supply the fundamental current.
The load + **OSF** active harmonics conditioner assembly will then be seen by the utility power as a globally linear load which absorbs sinusoidal current. Thus, the cabling and generator impedances will not introduce any voltage distortion.



device functional features

The **OSF** active harmonics conditioner allows:
■ determination of the harmonic orders to be compensated:
□ by configuring the breadth of the spectrum to be compensated (H2 to H25 max.),
□ or by concentrating the capacity of the **OSF** compensation on specific harmonic orders during installation and thus carrying out selective compensation;
■ reactive energy compensation to be carried out so as to increase the load cosine and return to the cosine range applied by the energy utility;
■ measurements and other variables calculated by the device (voltage, current, distortion rates, etc.) to be displayed;
■ optional communication with an external controller via a J-BUS protocol RS422/485 link for:
□ transmitting display information,
□ receiving RUN and STOP orders.

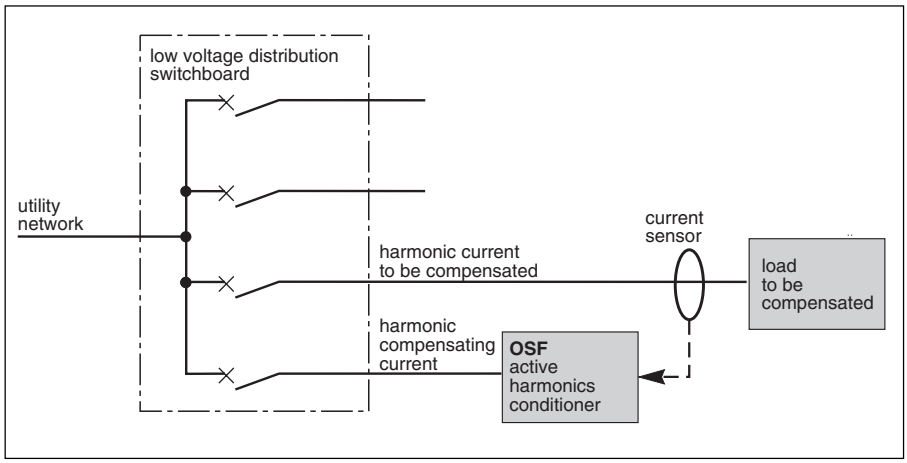
The compensation introduced by **OSF** in relation to harmonic and reactive currents is continuously recalculated;
■ the **OSF** active harmonics conditioner continuously measures current absorbed by the load and immediately modifies the current that it reinjects onto the utility power to match this value;
■ the **OSF** active harmonics conditioner is suitable for all installation load and harmonic spectrum variations thus guaranteeing optimum operation at any instant.

standard arrangements

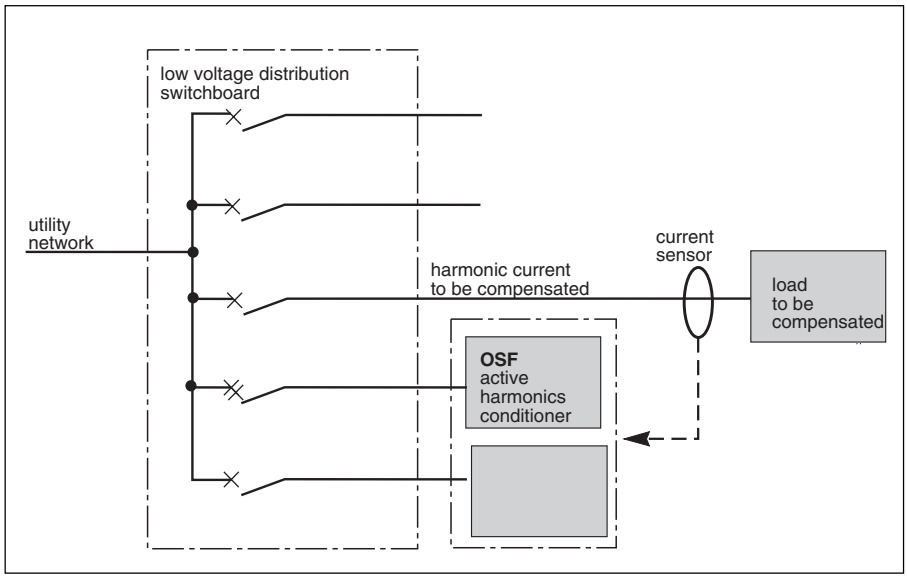
Depending on the type of problem to be solved, the position of the sensors and that of the The **OSF** harmonics conditioner connection point may be different from one installation to another.
The audit carried out before installation enables the optimum respective positions to be determined.
■ The **OSF** conditioner is connected in parallel with the load.

The **OSF** harmonics conditioner will be fed from a specific outgoing feeder. This line must be protected by a circuit-breaker. The **OSF** conditioner uses this line to send harmonics destined to compensate the load harmonics back onto the utility power.

Case of a 20 A, 30 A, 45 A or 60 A unit OSF conditioner



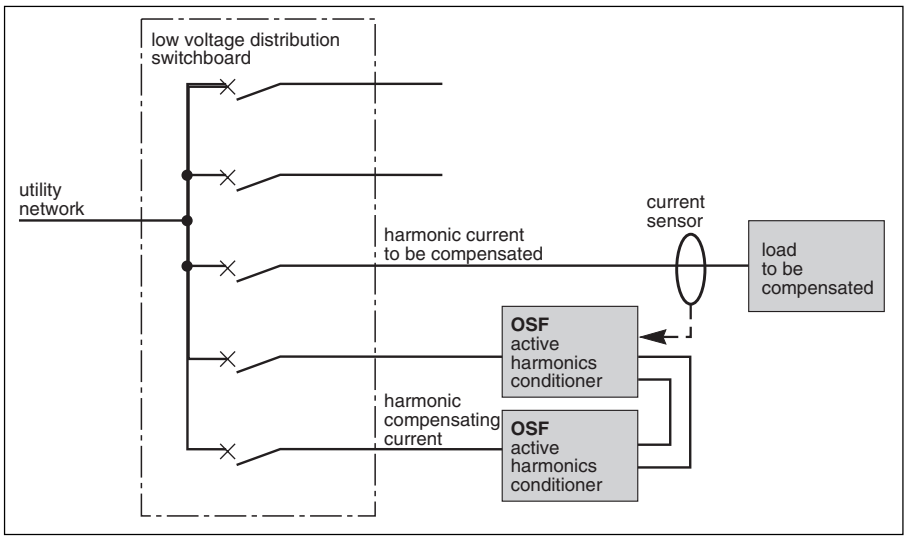
Case of a 90 A or 120 A unit OSF conditioner



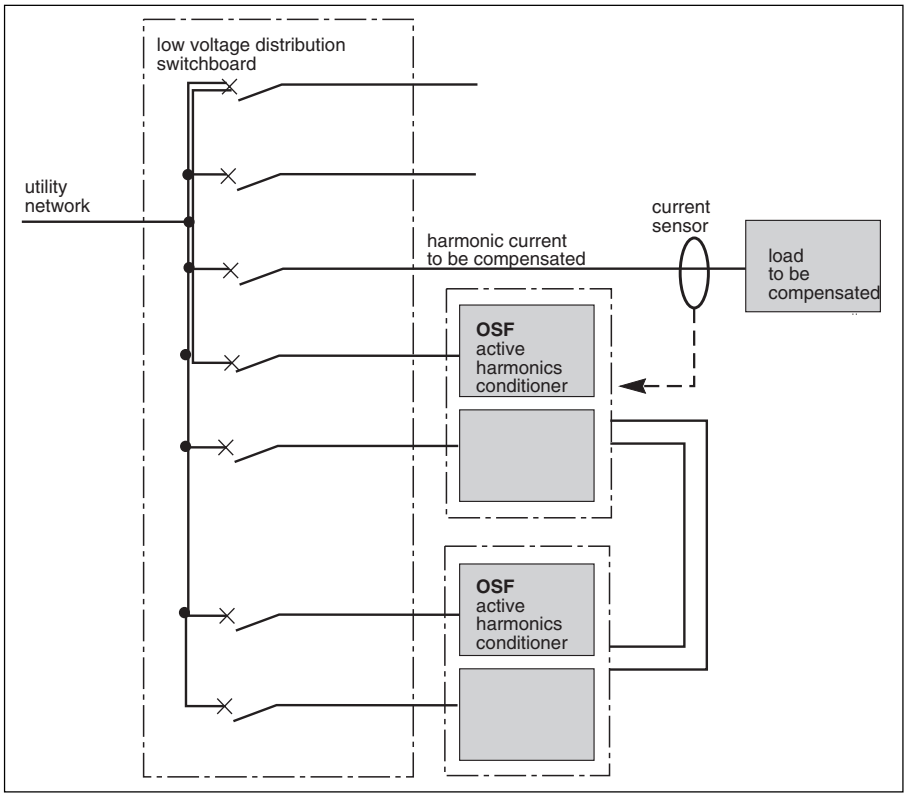
- each conditioner independently uses current measurements from three sensors, whatever the state of the other conditioner; running, stopped, de-energized;
- two cables between the conditioners allow each to know the otherÕs state and thus determine the share of harmonics that it has to supply: half or all if the other conditioner is not running;
- each power circuit remains independent and has its own protection;
- it is possible to connect up to
- conditioners with the same rating in parallel to compensate the same load or the same group of loads.

Case of 2 parallel 20 A, 30 A, 45 A, 60 A, 90 A or 120 A OSF conditioners

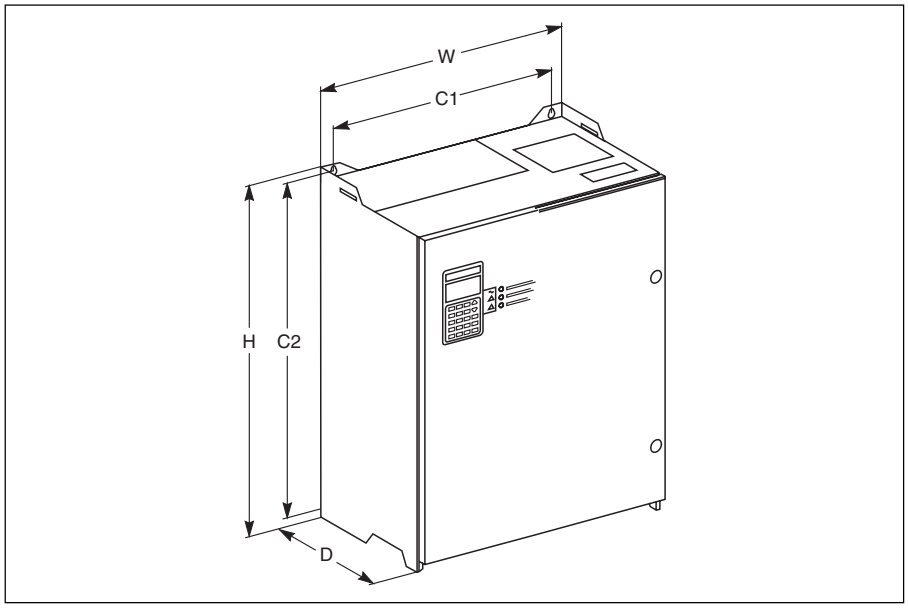
Example of 2 parallel 20, 30, 45 or 60 A **OSF** conditioners:



Example of 2 parallel 90 or 120 A **OSF** conditioners:



installing device(s)
Mechanical characteristics



dimensions (mm)			fixing centre distance (mm)		diameter of fixing screws (mm)	mass (kg)
height H	width W	depth D	width C1	height C2		
● 20 A and 30 A conditioners						
680	540	280	475	660	8	65
● 45 A and 60 A conditioners						
780	590	325	525	760	8	110

● 90 A and 120 A conditioners are made up of two cubicles having the same dimensions as the 45 and 60 A conditioners. These cubicles can be placed side by side or on top of one another (subject to installation requirements relating to ventilation).

Installation requirements

The **OSF** active harmonics conditioner must be mounted vertically and away from any source of heat (heating system, transformer, motor, etc.).

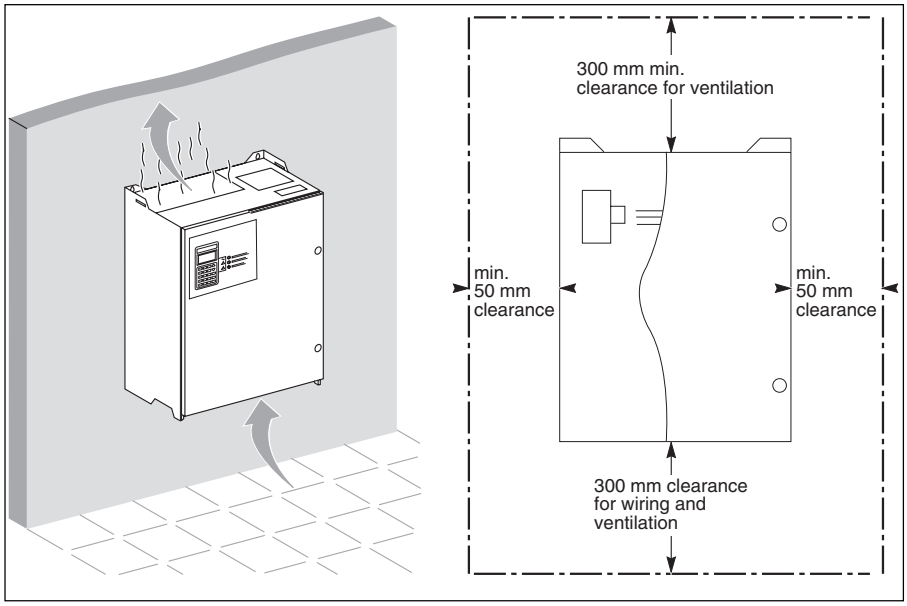
■ it may be installed in a cubicle or fixed against a wall.

Whatever the installation method, a 600 mm minimum clearance must be provided in front of the **OSF** conditioner allowing for the door to be completely opened.

installing a OSF conditioner alone

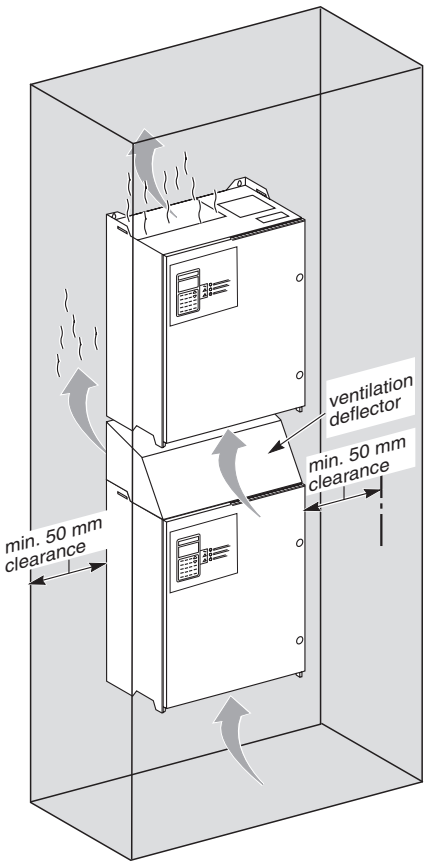
■ clearances must be provided to allow the circulation of an air flow:
□ 1000 m³ per hour for 20 to 60 A ratings
□ 2000 m³ per hour for 90 to 120 A ratings.
The air is sucked in below the conditioner and expelled via the top;
■ the air temperature at the inlet of each conditioner must not exceed 40 degrees (25 °C recommended);
■ the power cables and fine wires arrive via the bottom of the conditioner;

To install a 90 A or 120 A conditioner, refer to how to install 2 conditioners on top of each other or side by side.

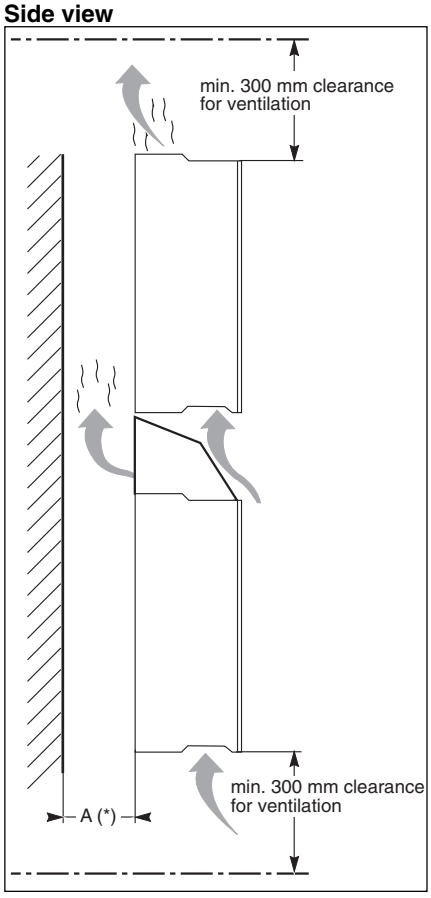


Installing 2 OSF conditioners on top of each other in a cubicle:

Installing 2 **OSF** conditioners on top of each other must only be done inside a cubicle.
■ openings must be provided at the top and bottom of the cubicle to help the conditioners to cool down;
■ a ventilation deflector must be used so that the thermal characteristics of the 2 conditioners are respected. The distance between the two cubicles is determined by the height; the air is sucked below each conditioner and then expelled:
□ out the top for the top conditioner,
□ to the rear for the bottom conditioner;
■ the air flow required for cooling the cubicle is 2000 m³ per hour;
■ the air temperature at the inlet to each conditioner must not exceed 40 degrees (25 °C recommended);
■ power cables and signal cables arrive via the bottom of the conditioner.



Side view



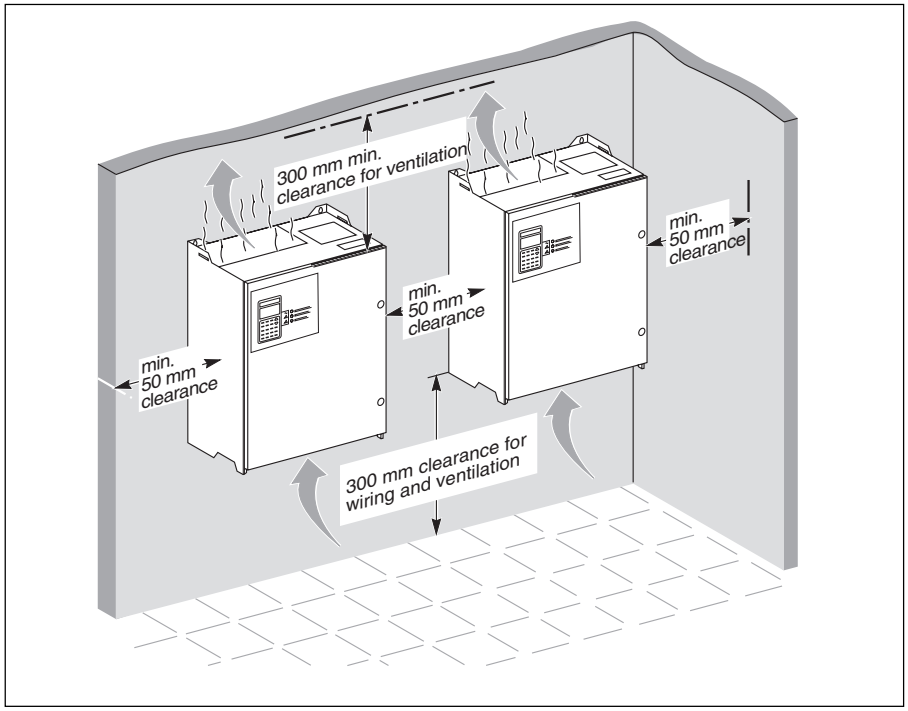
A = min. 80 mm : 20 to 30 A ratings
A = min. 200 mm : 45 to 120 A ratings

installing 2 OSF conditioners side by side

■ clearances must be provided to allow the circulation of an air flow of 1000 m^3 per hour per cubicle.
The air is sucked below each conditioner and then expelled out the top;

■ the air temperature at the inlet to each conditioner must not exceed 40 degrees (25 °C recommended);

■ power cables and signal cables arrive via the bottom of each conditioner.



Connecting power

Determining wiring (not supplied)

Wiring cross-sectional areas shall be determined in compliance with the standards in force using the information in the table opposite and the protection tables per rating:
care should be taken with neutral cable sizing, when the neutral is distributed, owing to the majority presence of third harmonic which may lead to the current tripling in the neutral in relation to the phases.

The minimum cable cross-sectional areas can be determined based on the sizing current (Is) given in the tables below.

It is advisable to connect the neutral when it is distributed.

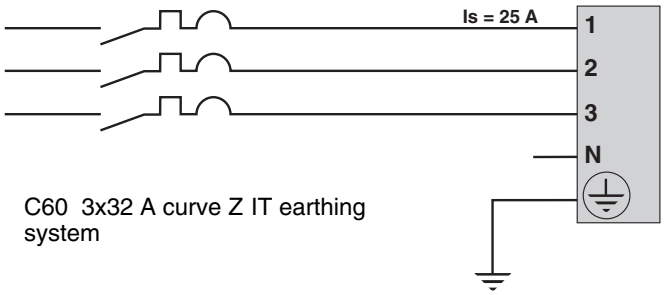
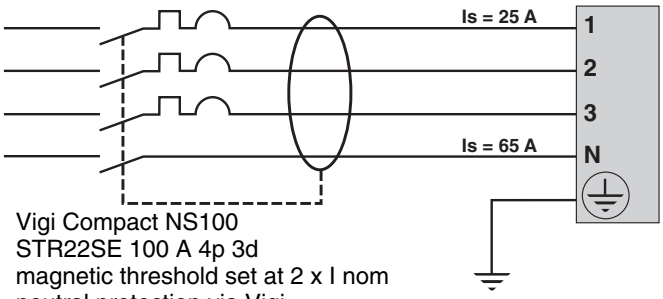
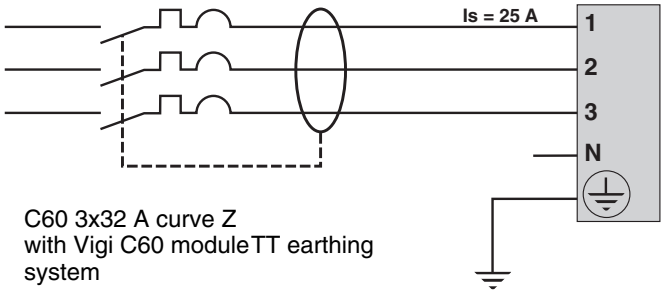
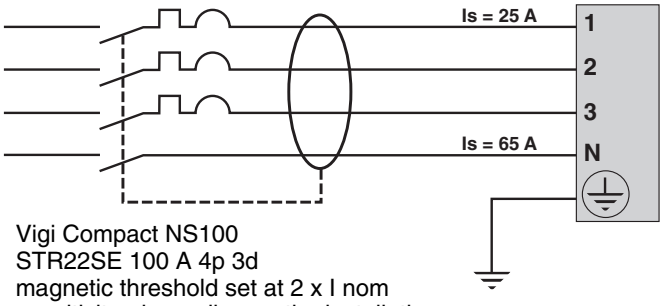
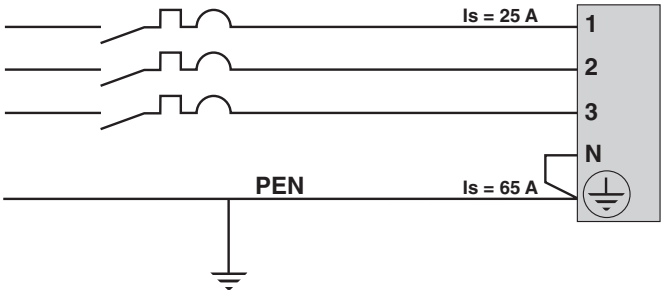
SineWave[a] rating (A)	Recommended cross-sectional areas (mm^2) capacity		terminal block connection (mm) (mm^2)	diameter of lugs power cables	maximum length of (m)
	phases	neutral			
20	2,5	16	35	6	20
30	4	25	35	6	20
45	10	50	70	8	20
60	16	70	70	8	20
90	10 per cubicle	50 per cubicle	70	8	20
120	16 per cubicle	70 per cubicle	70	8	20

Protections (not supplied)

Protections shall be determined in compliance with the standards in force using the information below and in accordance with selectivity requirements. These models are for guidance only and do not involve the responsibility of FRAKO GmbH.

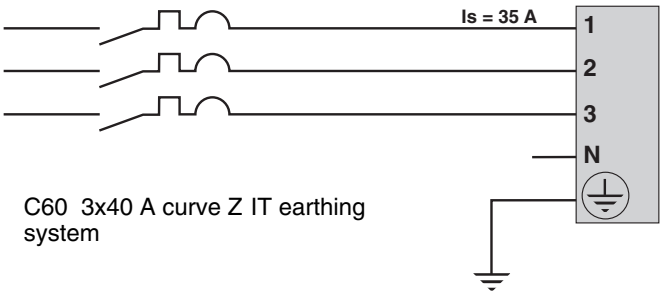
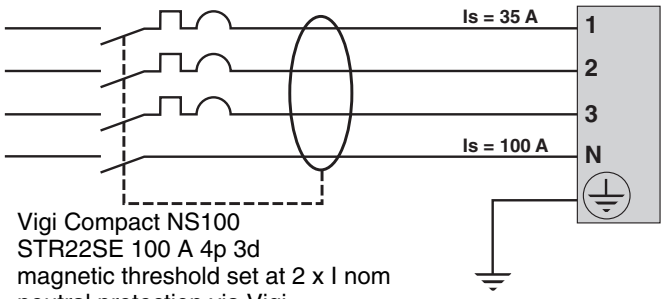
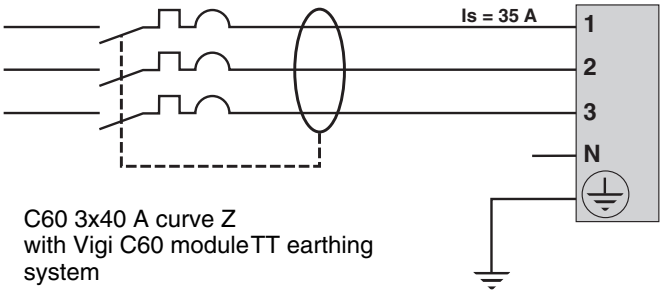
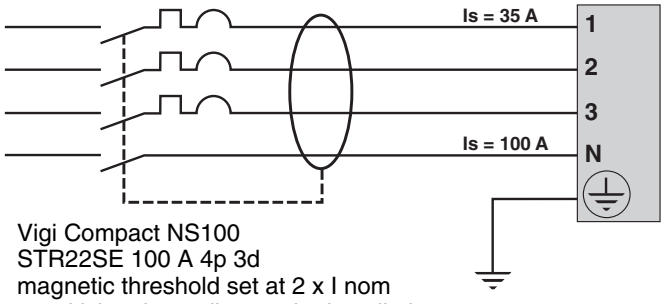
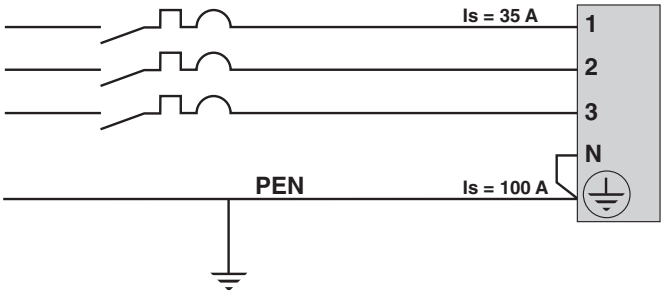
OSF 20 A

Table of recommended protections per rating
Connection to the OSF terminal block where Pcu = function of Isc

Non-distributed neutral	Distributed neutral
IT earthing system  C60 3x32 A curve Z IT earthing system	**IT earthing system**  Vigi Compact NS100 STR22SE 100 A 4p 3d magnetic threshold set at 2 x I nom neutral protection via Vigi sensitivity: 10 A
TT earthing system  C60 3x32 A curve Z with Vigi C60 moduleTT earthing system	**TT earthing system**  Vigi Compact NS100 STR22SE 100 A 4p 3d magnetic threshold set at 2 x I nom sensitivity: depending on the installation
	TNC earthing system  C60 3x32 A curve Z
Important: upstream breaking devices should be set in such a way as to guarantee good discrimination with the circuit-breakers recommended on this page. **Key:** Is = sizing current Pcu = breaking capacity Isc = short-circuit current	**TNS earthing system**  NS100 STR22SE 100 A 4p 3d magnetic threshold set at 2 x I nom

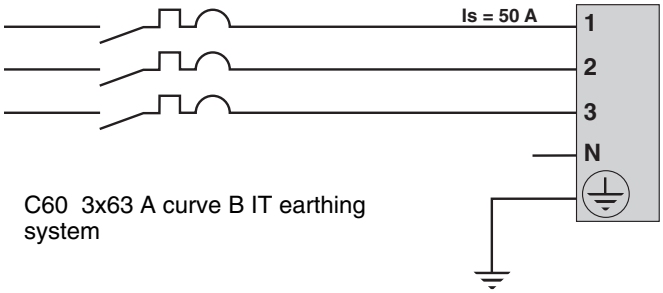
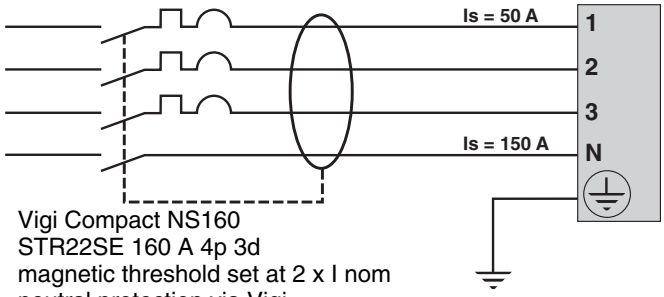
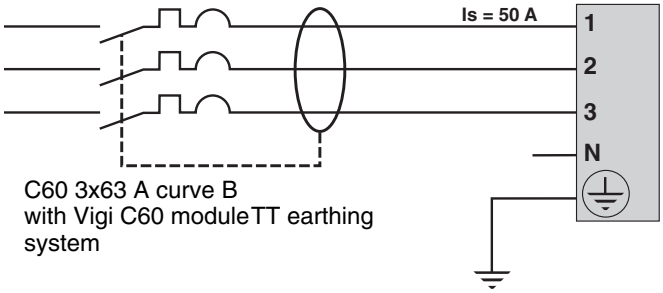
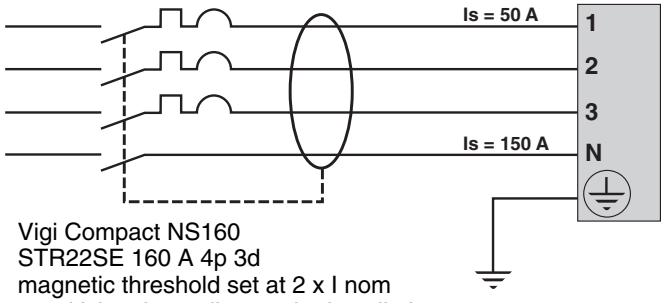
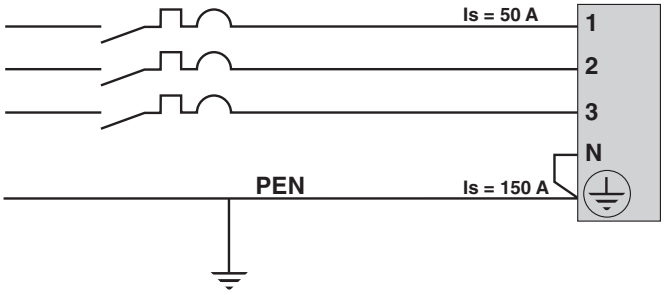
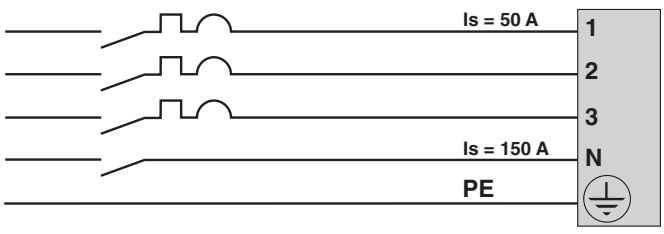
OSF 30 A

Table of recommended protections per rating
Connection to the OSF terminal block where Pcu = function of Isc

Non-distributed neutral	Distributed neutral
IT earthing system  C60 3x40 A curve Z IT earthing system	**IT earthing system**  Vigi Compact NS100 STR22SE 100 A 4p 3d magnetic threshold set at 2 x I nom neutral protection via Vigi sensitivity: 10 A
TT earthing system  C60 3x40 A curve Z with Vigi C60 moduleTT earthing system	**TT earthing system**  Vigi Compact NS100 STR22SE 100 A 4p 3d magnetic threshold set at 2 x I nom sensitivity: depending on the installation
	TNC earthing system  C60 3x40 A curve Z
Important: upstream breaking devices should be set in such a way as to guarantee good discrimination with the circuit-breakers recommended on this page. **Key:** Is = sizing current Pcu = breaking capacity Isc = short-circuit current	**TNS earthing system**  NS100 STR22SE 100 A 4p 3d magnetic threshold set at 2 x I nom

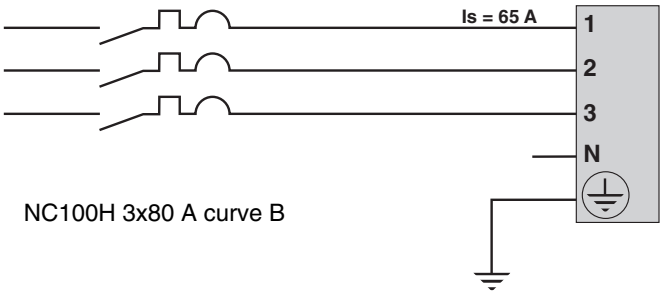
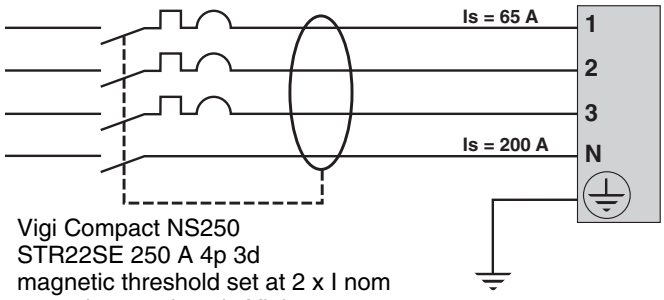
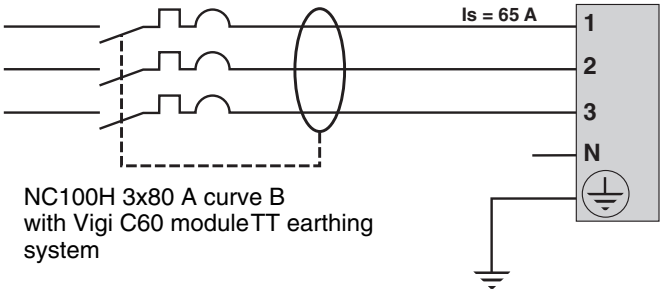
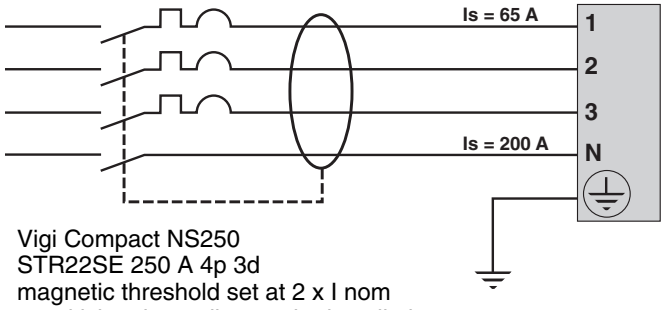
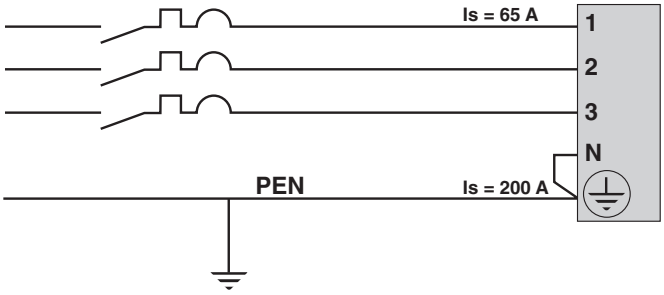
OSF 45 A

Table of recommended protections per rating
Connection to the OSF terminal block where Pcu = function of Isc

Non-distributed neutral	Distributed neutral
IT earthing system  C60 3x63 A curve B IT earthing system	**IT earthing system**  Vigi Compact NS160 STR22SE 160 A 4p 3d magnetic threshold set at 2 x I nom neutral protection via Vigi sensitivity: 10 A
TT earthing system  C60 3x63 A curve B with Vigi C60 moduleTT earthing system	**TT earthing system**  Vigi Compact NS160 STR22SE 160 A 4p 3d magnetic threshold set at 2 x I nom sensitivity: depending on the installation
	TNC earthing system  C60 3x63 A curve B
Important: upstream breaking devices should be set in such a way as to guarantee good discrimination with the circuit-breakers recommended on this page. **Key:** Is = sizing current Pcu = breaking capacity Isc = short-circuit current	**TNS earthing system**  NS160 STR22SE 160 A 4p 3d magnetic threshold set at 2 x I nom

OSF 60 A

Table of recommended protections per rating
Connection to the OSF terminal block where Pcu = function of Isc

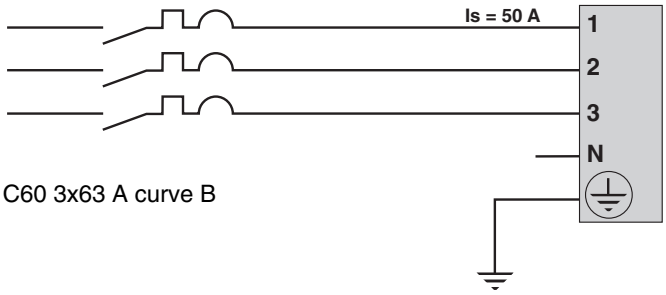
Non-distributed neutral	Distributed neutral
IT earthing system  NC100H 3x80 A curve B	**IT earthing system**  Vigi Compact NS250 STR22SE 250 A 4p 3d magnetic threshold set at 2 x I nom neutral protection via Vigi sensitivity: 10 A
TT earthing system  NC100H 3x80 A curve B with Vigi C60 moduleTT earthing system	**TT earthing system**  Vigi Compact NS250 STR22SE 250 A 4p 3d magnetic threshold set at 2 x I nom sensitivity: depending on the installation
	TNC earthing system  NC100H 3x80 A curve B
Important: upstream breaking devices should be set in such a way as to guarantee good discrimination with the circuit-breakers recommended on this page. **Key:** Is = sizing current Pcu = breaking capacity Isc = short-circuit current	**TNS earthing system**  NS250 STR22SE 250 A 4p 3d magnetic threshold set at 2 x I nom

OSF 90 A with non-distributed neutral

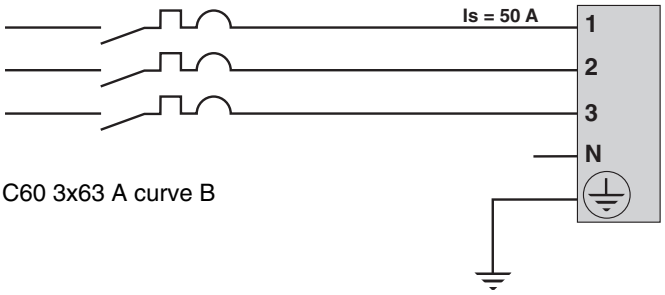
Table of recommended protections per rating
Connection to the OSF terminal block where Pcu = function of Isc

Non-distributed neutral

IT earthing system

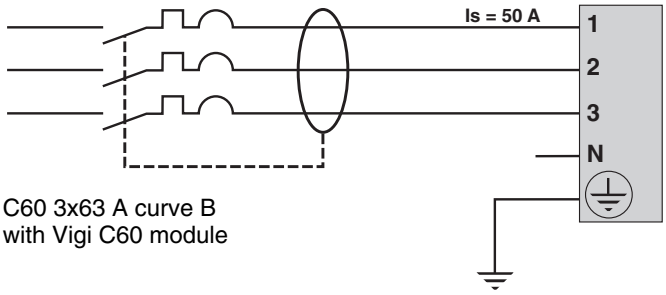


C60 3x63 A curve B

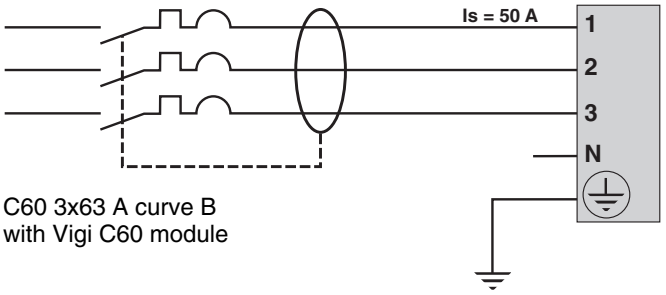


C60 3x63 A curve B

TT earthing system



C60 3x63 A curve B
with Vigi C60 module



C60 3x63 A curve B
with Vigi C60 module

Important: upstream breaking devices should be set in such a way as to guarantee good discrimination with the circuit-breakers recommended on this page.

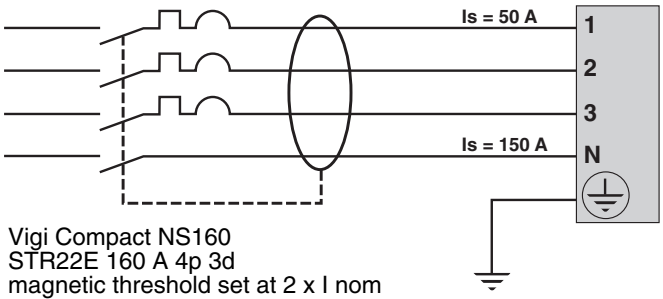
Key: Is = sizing current
Pcu = breaking capacity
Isc = short-circuit current

OSF 90 A with distributed neutral

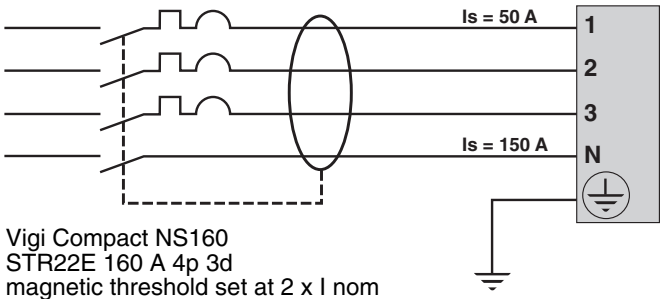
Table of recommended protections per rating
Connection to the OSF terminal block where Pcu = function of Isc

Distributed neutral

IT earthing system

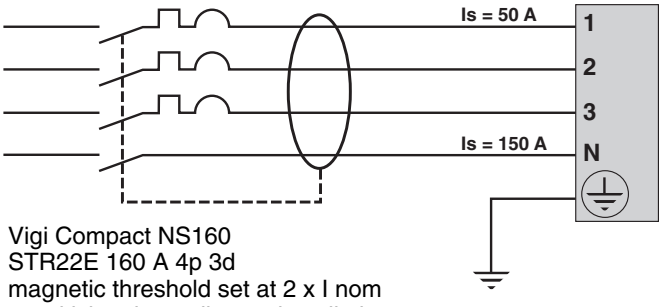


Vigi Compact NS160
STR22E 160 A 4p 3d
magnetic threshold set at 2 x I nom
neutral protection via Vigi
sensitivity: 10 A

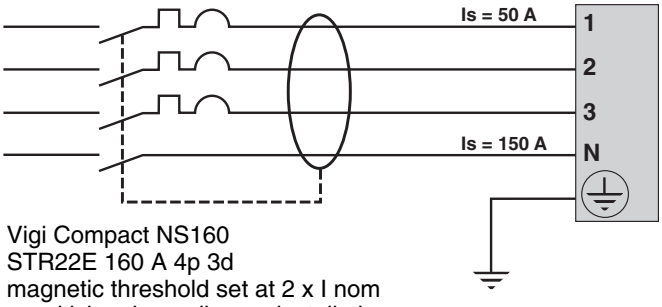


Vigi Compact NS160
STR22E 160 A 4p 3d
magnetic threshold set at 2 x I nom
neutral protection via Vigi
sensitivity: 10 A

TT earthing system

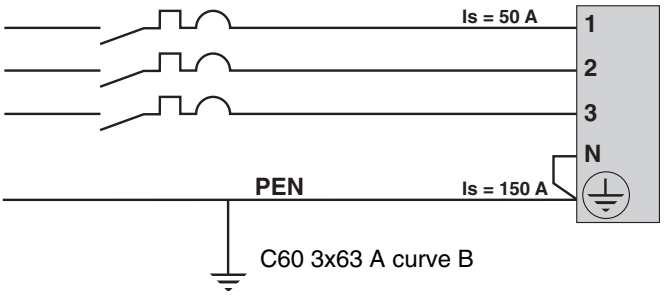


Vigi Compact NS160
STR22E 160 A 4p 3d
magnetic threshold set at 2 x I nom
sensitivity: depending on installation

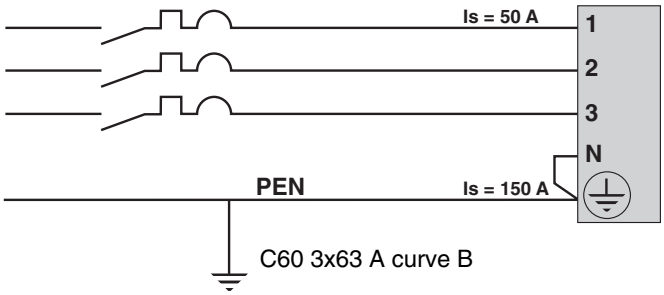


Vigi Compact NS160
STR22E 160 A 4p 3d
magnetic threshold set at 2 x I nom
sensitivity: depending on installation

TNC earthing system



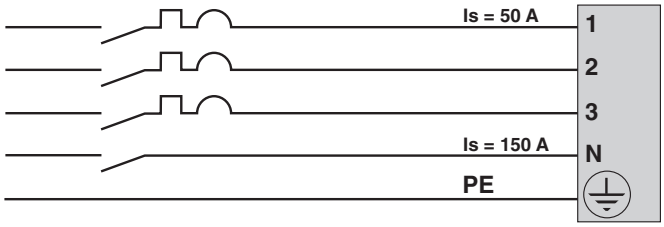
C60 3x63 A curve B



C60 3x63 A curve B

TNS earthing system

NS160 STR22E 160 A 4p 3d
magnetic threshold set at 2 x I nom



NS160 STR22E 160 A 4p 3d
magnetic threshold set at 2 x I nom

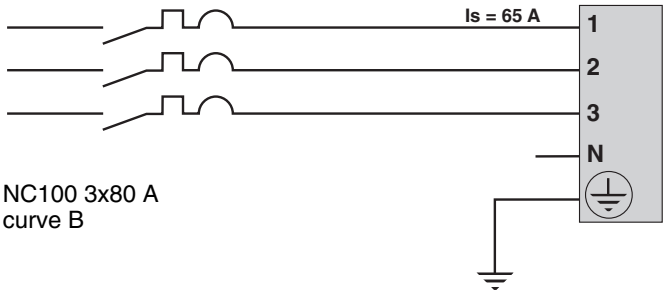
Important: upstream breaking devices should be set in such a way as to guarantee good discrimination with the circuit-breakers recommended on this page.

OSF 120 A with non-distributed neutral

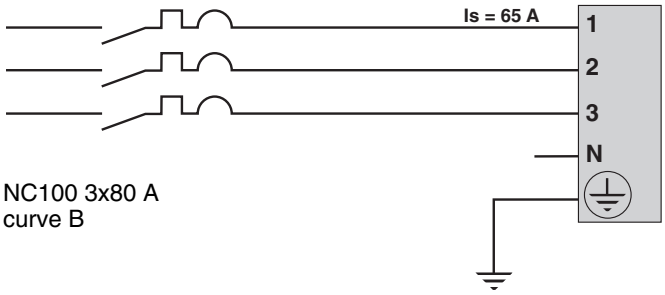
Table of recommended protections per rating
Connection to the OSF terminal block where Pcu = function of Isc

Non-distributed neutral

IT earthing system

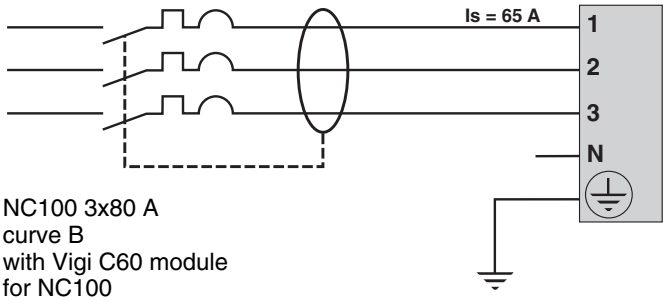


NC100 3x80 A
curve B

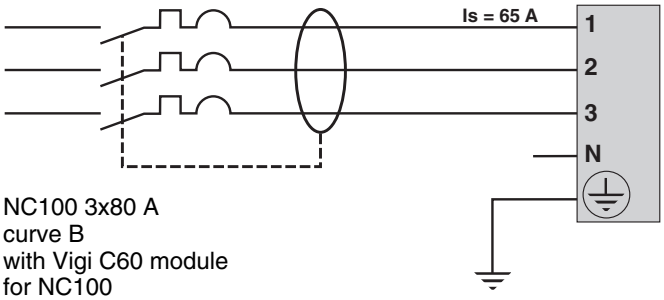


NC100 3x80 A
curve B

TT earthing system



NC100 3x80 A
curve B
with Vigi C60 module
for NC100



NC100 3x80 A
curve B
with Vigi C60 module
for NC100

Important: upstream breaking devices should be set in such a way as to guarantee good discrimination with the circuit-breakers recommended on this page.

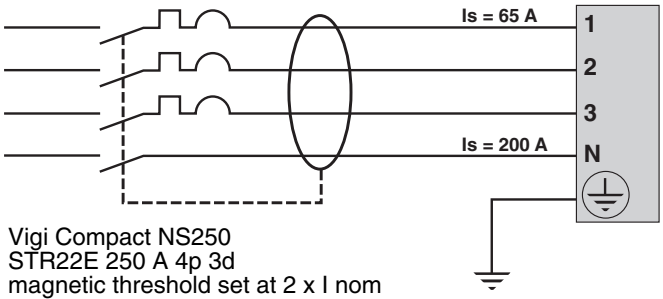
Key: Is = sizing current
Pcu = breaking capacity
Isc = short-circuit current

OSF 120 A with distributed neutral

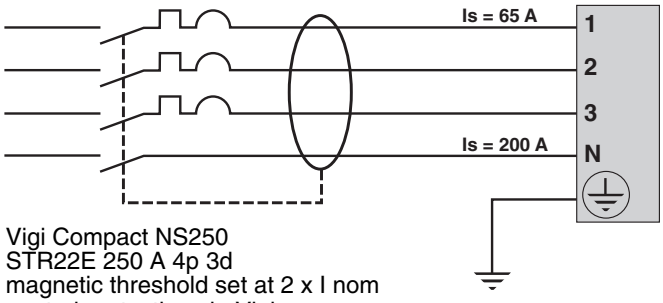
Table of recommended protections per rating
Connection to the OSF terminal block where Pcu = function of Isc

Distributed neutral

IT earthing system

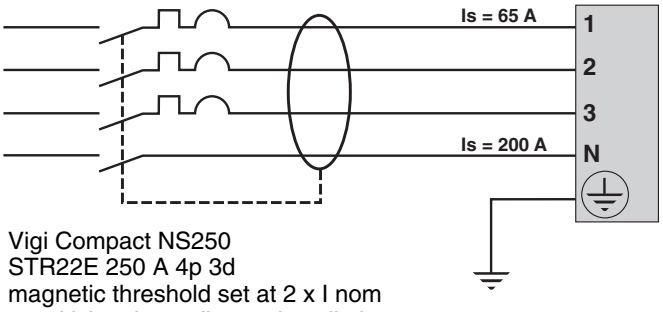


Vigi Compact NS250
STR22E 250 A 4p 3d
magnetic threshold set at 2 x I nom
neutral protection via Vigi
sensitivity: 10 A

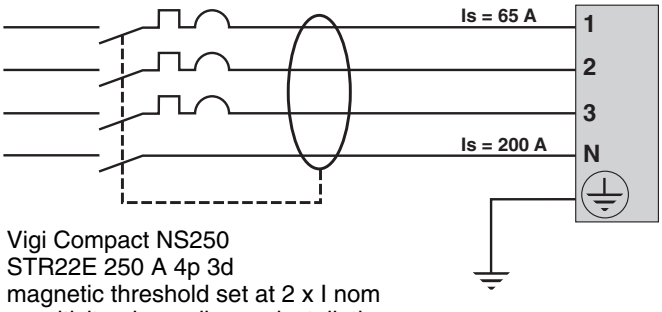


Vigi Compact NS250
STR22E 250 A 4p 3d
magnetic threshold set at 2 x I nom
neutral protection via Vigi
sensitivity: 10 A

TT earthing system

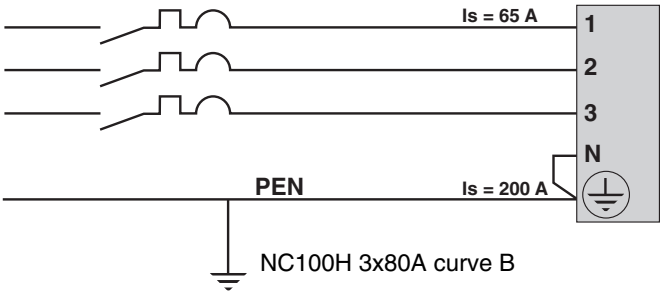


Vigi Compact NS250
STR22E 250 A 4p 3d
magnetic threshold set at 2 x I nom
sensitivity: depending on installation

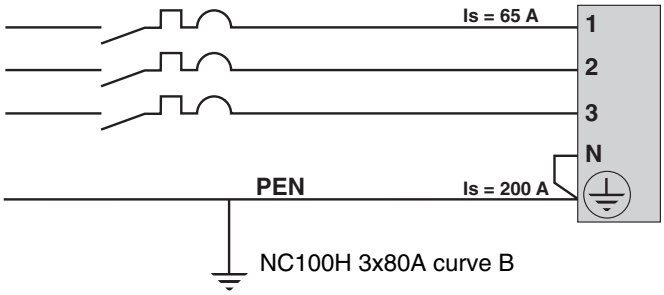


Vigi Compact NS250
STR22E 250 A 4p 3d
magnetic threshold set at 2 x I nom
sensitivity: depending on installation

TNC earthing system



NC100H 3x80A curve B



NC100H 3x80A curve B

TNS earthing system

NS250 STR22E 250 A 4p 3d
magnetic threshold set at 2 x I nom

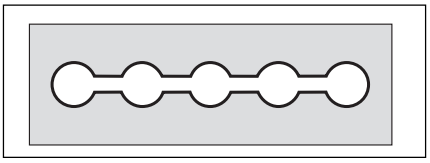
NS250 STR22E 250 A 4p 3d
magnetic threshold set at 2 x I nom

Important: upstream breaking devices should be set in such a way as to guarantee good discrimination with the circuit-breakers recommended on this page.

Connection operations:

Connection operations must be carried out without the conditioners being energized.
For the protection of persons, remember that the PE or PEN protective conductor must always be connected first.
Earthing system: **OSF** is suited to all types of earthing system.

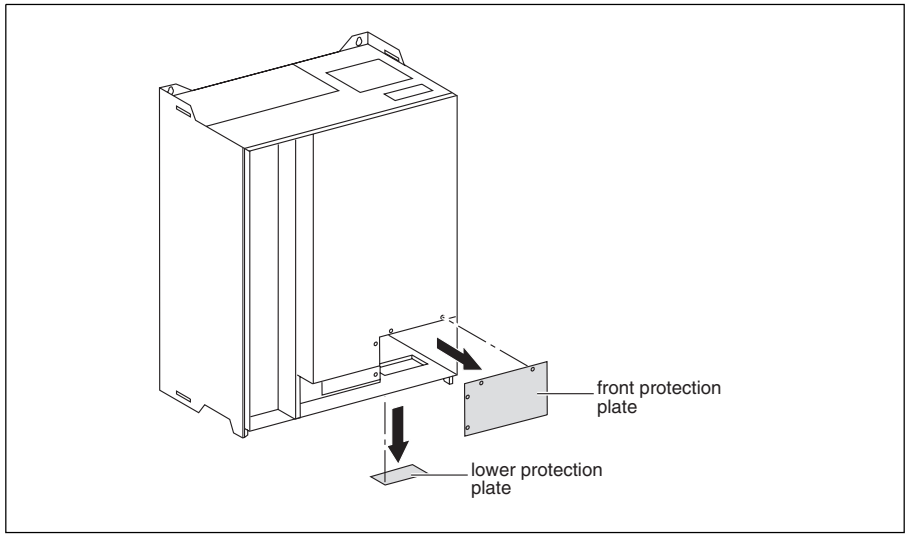
Procedure:
- check that the lifting sling has been removed;
- check that the **OSF** supply circuit-breaker placed in your low voltage switch cubicle is in open position (O);
- wiring is connected via the bottom, in front of the conditioner;
- to access the connection terminal block, remove the front and lower protection plates;
- power connections are made on the bolted terminal block;
- the lower protection plate of the power terminal block must be fitted with bushings for cable feedthrough. If several holes are made to feed the cables through, cut a slot common to all the holes to prevent eddy currents from being generated;

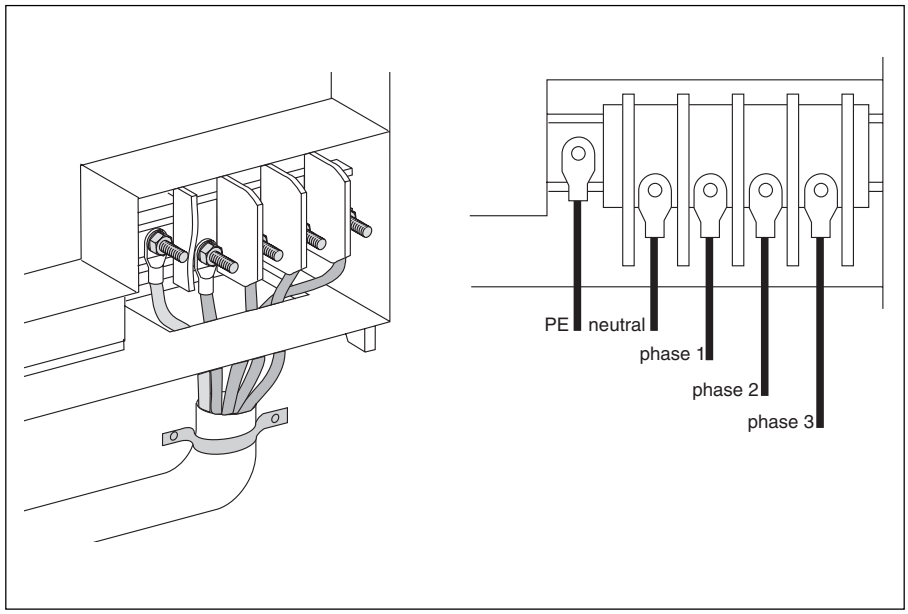


- connect the PE or PEN conductor first;
- connect the other conductors so that they comply with the rotation direction of the phases and the indications in the figures opposite.

The connecting cables must be mechanically fixed near the terminal block so that any mechanical stress on the conductors is prevented.

Note:
If there is traction on the cables, the PE or PEN must be the last conductor subject to its effects.





Connecting dry contacts and communication port (optional)

Determining wiring

connector	cross-sectional area (mm^2)	type of recommended conductor	remark
dry contact terminal block	0.5 mini 2.5 max	multi-core wires (not supplied)	removable screw terminal block (supplied)
9 point Sub-D	shielded cable (not supplied)		male connector with female contacts on **OSF** ; the shielding must be connected at both ends.

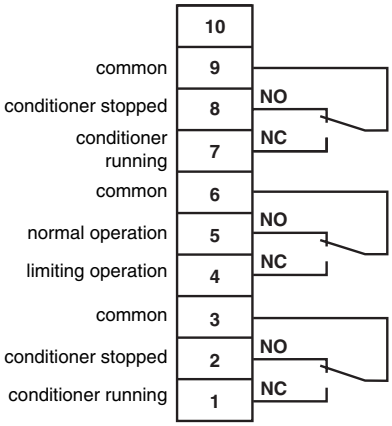
Connection operations

Procedure:

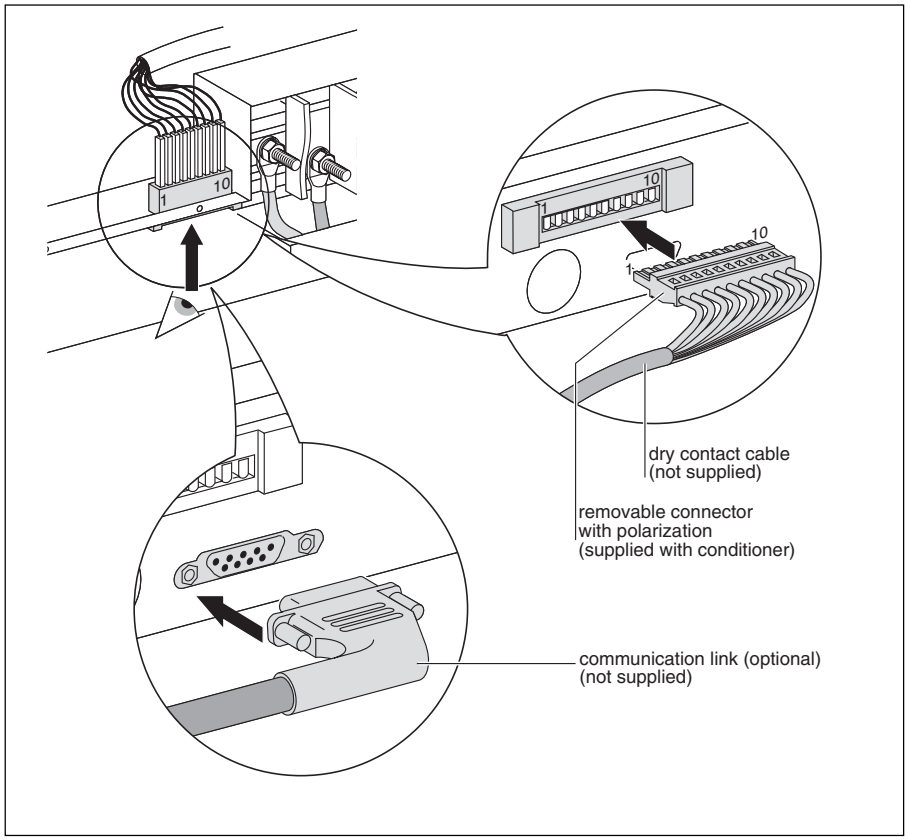
■ wiring is connected via the bottom, in front of the device.

Signal cable connections must be mechanically fixed near the connectors so that any mechanical stress on the conductors is prevented

■ configuration of dry contact terminal block:
□ 2 x voltage-free changeover switches: conditioner running/stopped,
□ 1 x voltage-free changeover switch: current-limiting operation;
■ connection to the terminal block may be made whilst **OSF** is operating;
■ these contacts comply with safe extra low voltage insulating requirements.

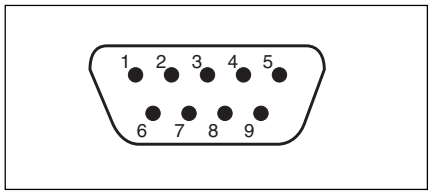


Contact breaking capacity:
P = 2 VA, U = 30 V max.,
I = 1 A max.



■ configuration of 9 point Sub-D connector for RS 422/485 communication link (optional);
■ the communication link can be plugged into the sub-D connector without shutting down the **OSF** ;
■ this interface complies with safe extra low voltage insulating requirements.

OSF connector
seen from below



Key:
pin 1: 0 volts
pin 2: RP_5V
pin 3: RC_A
pin 4: RDÐ(BÕ)
pin 5: TDÐ(B)
pin 6: RP_0V
pin 7: RC_B
pin 8: RD+(AÕ)
pin 9: TD+(A)

Connecting ribbon cables for the 90 or 120 A and for parallel installation

Type of connections

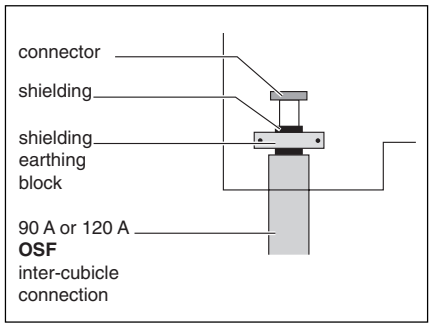
connector	type of conductors	remark
OSF 90 or 120 A inter-cubicle connector	shielded strand supplied (3 m)	connection between the 2 cubicles which make up the OSF 90 or 120 A
OSF parallel connector	shielded strand supplied (5 m)	loop connection allows parallel operation of the **OSF** even if it is interrupted for the number of devices to be modified

Connection operations for parallel or 90 A or 120 A conditioners

Connection operations must be carried out with the conditioner de-energized.

Procedure:

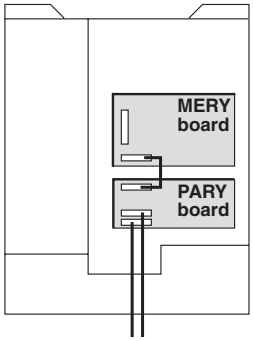
- wiring is connected via the bottom, in front of the device;
- remove the protection plate;
- the conductor connectors must be correctly locked;
- shielding shall be earthed in compliance with the indications given below;



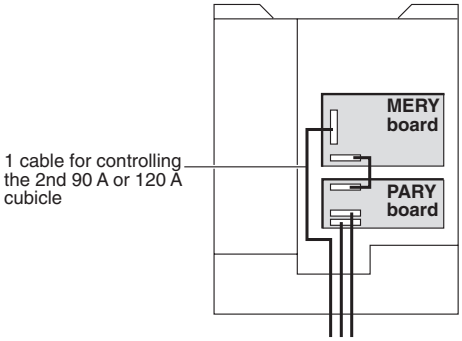
- configure the parallel connection board using the indications in the table below.

Signal cables connections must be mechanically fixed near the connectors so that any stress on the conductors or conductor shielding earthing is prevented.

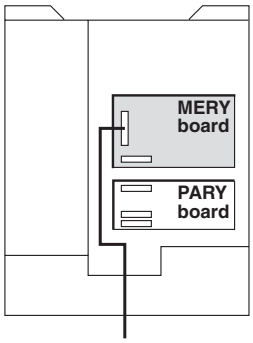
20 A or 60 A parallel conditioner connection



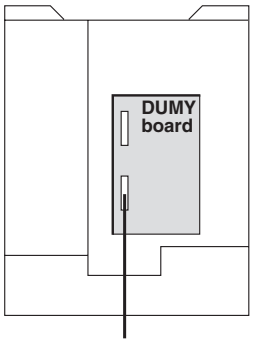
90 A or 120 A parallel conditioner connection



90 A or 120 A parallel conditioner connection



2nd 90 or 120 A conditioner cubicle connection



Close-up of connectors

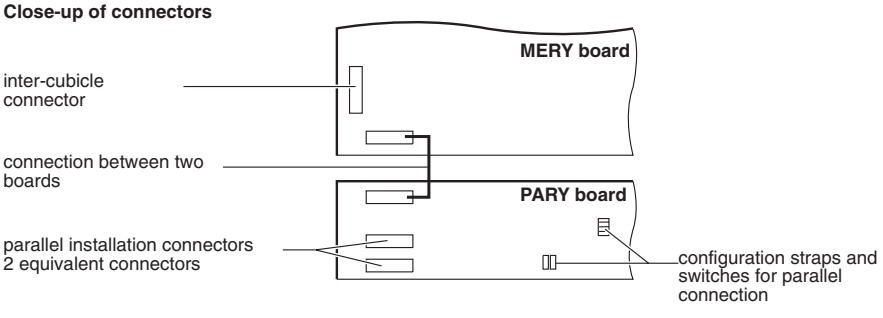
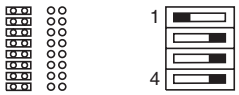
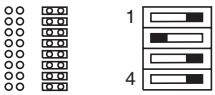
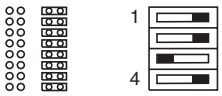
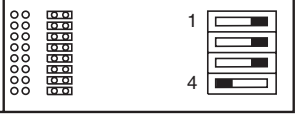


Table of strap configurations for each parallel conditioner

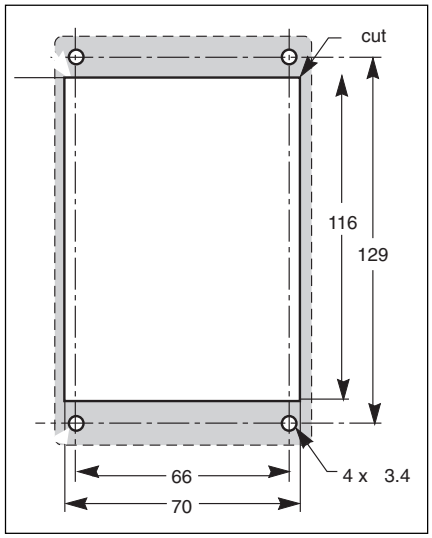
	OSF number 1	OSF number 2	OSF number 3	OSF number 4
configuration of parallel conditioners				

Moving graphic terminal

The **OSF** harmonics conditioner graphic terminal can be moved to the front panel of a switch cubicle where a **OSF** is installed.

■ To do this, use the optional kit reference n° 5102726400 which contains:
□ a cover plate replacing the terminal located on the **OSF** door,
□ a 2.5 metre long extension lead. This lead cannot be lengthened without this causing a risk of abnormal operation;
■ Moving the graphic terminal:
□ disconnect the terminal ribbon cable on the back of the door,
□ remove the terminal by unscrewing the 4 fixing screws,
□ use these 4 screws to fix the cover plate in place of the terminal,
□ connect the ribbon cable onto the extension lead,
□ feed the extension lead through the rectangular bushing at the bottom of the **OSF** conditioner,
□ fix the terminal at the required location,
□ connect the extension lead to the graphic terminal.

Cutting and fixing template for the moved terminal

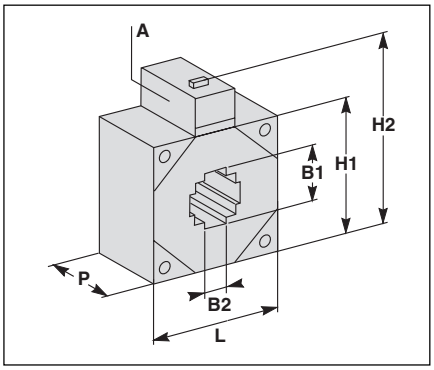


installing current sensors (supplied)

Once installed, the current sensor secondaries must be short-circuited via the pullout terminals, or equivalent terminals (not supplied). These pullout terminals will remain in closed position as long as they are not connected to the **OSF** conditioner.

Sensor mechanical and electrical characteristics

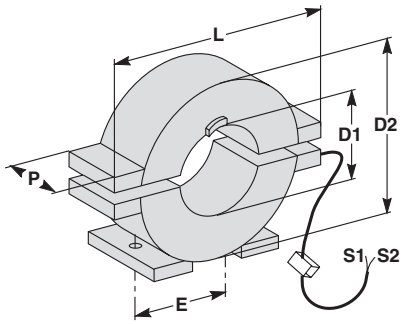
Closed sensors:
Important: the shape of the sensor may be different depending on the rating and supplier.



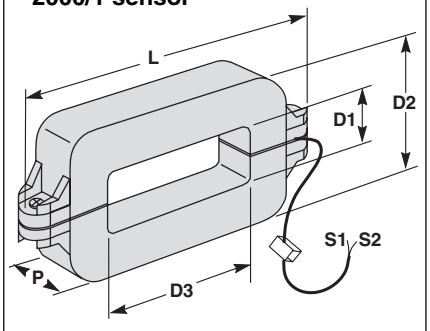
rating	external dimensions H1 / H2 / L / P (mm)	primary B1 / B2 (mm)	primary max. cable diameter	secondary diameter of lugs (A)	secondary cross-sectional area of wires (twisted 2-core cables) (mm^2)	secondary max. length of wires (not supplied) (m)
300/1 500 / 1	76 / 106 76 / 44	31 / 11	23	3 or 5 depending on supplier	0.75 min. 0.75 recommended 2.5 max.	20
1000/1	90 / 106 77 / 44	41 / 11	31	3 or 5 depending on supplier	0.75 min. 0.75 recommended 2.5 max.	20
1500/1	165 / 194 95 / 40	103 / 22	rod only	3 or 5 depending on supplier	0.75 min. 0.75 recommended 2.5 max.	20
2000/1	165 / 194 95 / 40	103 / 22	rod only	3 or 5 depending on supplier	0.75 min. 0.75 recommended 2.5 max.	20
3000/1	180 / 209 115 / 45	103 / 32	rod only	3 or 5 depending on supplier	0.75 min. 0.75 recommended 2.5 max.	20
4000/1	180 / 209 115 / 45	103 / 32	rod only	3 or 5 depending on supplier	0.75 min. 0.75 recommended 2.5 max.	20

Opening sensors:
On wiring kit supplied:
S1 = blue
S2 = brown
The sensors must be closed and screwed on both sides.
600/1 sensor: it is advisable to fix the sensor onto the cable. Fixing lugs are provided for this purpose.

600/1 sensor



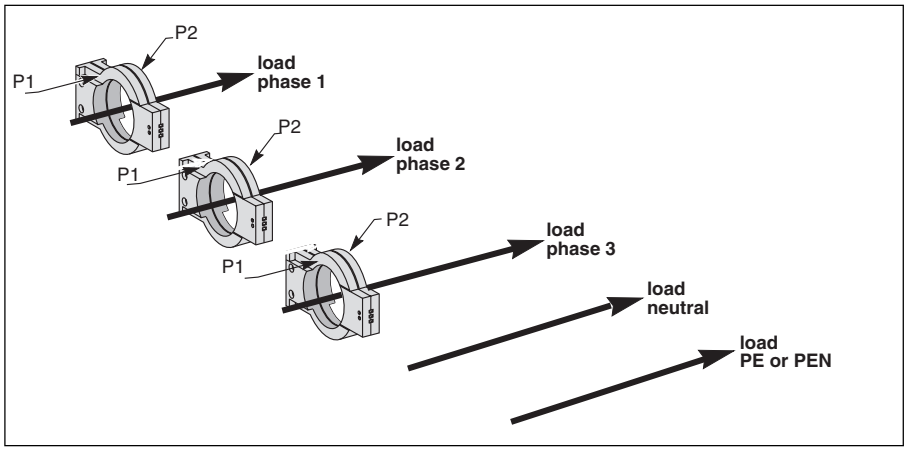
2000/1 sensor



rating	external dimensions (mm)	external fixing centre distance C (mm)	external diameter of screws (mm)	primary max. cable diameter	secondary fine wire connection	secondary cross-sectional area of wires (2-core cables)	secondary max. length of wires (m)
600/1	D2 = 96.5 L = 128 P = 35	60	6	D1 = 48	wiring kit supplied (5 m)	0.75 min. 0.75 recommended 2.5 max.	20
2000/1	D2 = 137.5 L = 298 P = 34			D1 = 69 or rod D1 = 69 D3 = 206	wiring kit supplied (5 m)	0.75 min. 0.75 recommended 2.5 max.	20

mounting direction of sensors

The current sensors must be mounted on each of the phases supplying the load.
They must be mounted in the direction shown in the figure opposite.



installing sensors

Once installed, the current sensor secondaries must be short-circuited via the pullout terminals, or equivalent terminals. These pullout terminals will remain in closed position as long as they are not connected to the **OSF** conditioner - see diagrams opposite.

- an intermediary terminal block (not supplied) must be installed for the 3 current sensors;
- it enables each of the 3 secondaries to be short-circuited;
- the **OSF** conditioner shall be connected to this terminal block.

For a 20 A, 30 A, 45 A or 60 A unit:

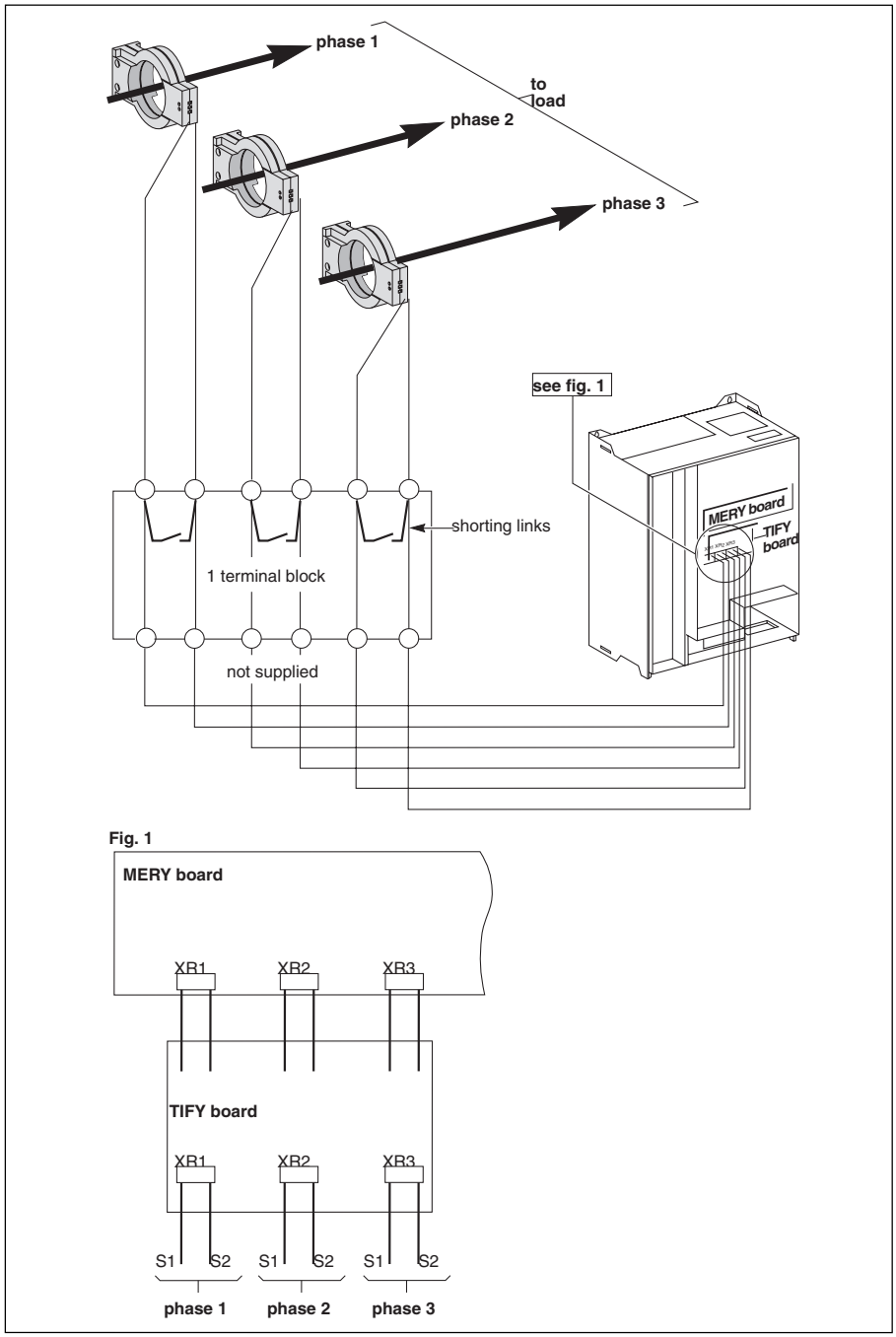


Fig. 1

■ an intermediary terminal block (not supplied) must be installed for the 3 current sensors:
■ it enables each of the 3 secondaries to be short-circuited;
■ the **OSF** onditioner shall be connected to this terminal block.

For a 90 A or 120 A unit:

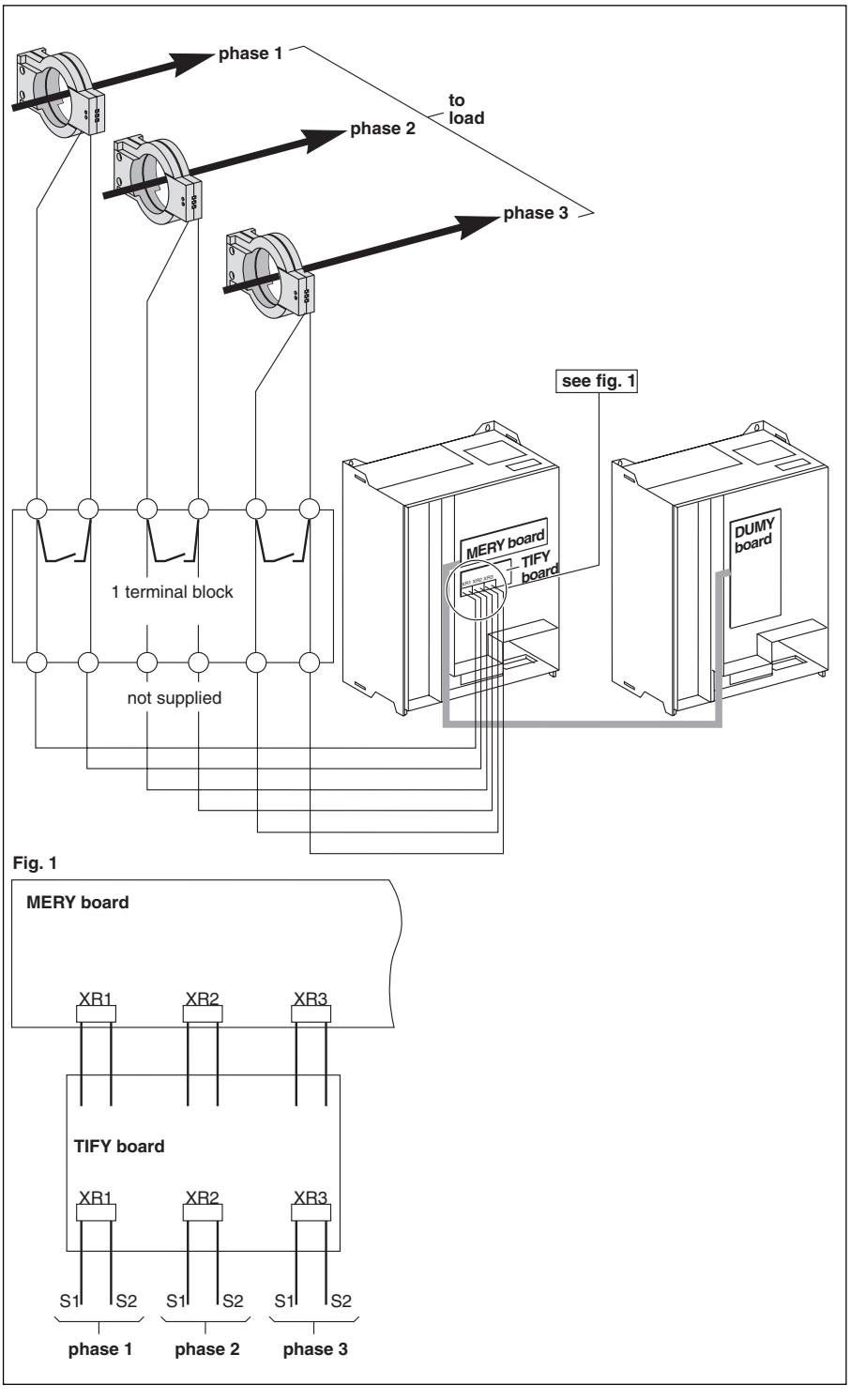


Fig. 1

■ an intermediary terminal block (not supplied) must be installed for the 3 current sensors:
■ it enables each of the 3 secondaries to be short-circuited;
■ one of the **OSF** conditioners shall be connected to this terminal block;
■ the connection leads supplied with the conditioners will allow the **OSF** conditioners to operate in parallel via loop communication.

For 90 A or 120 A parallel units:

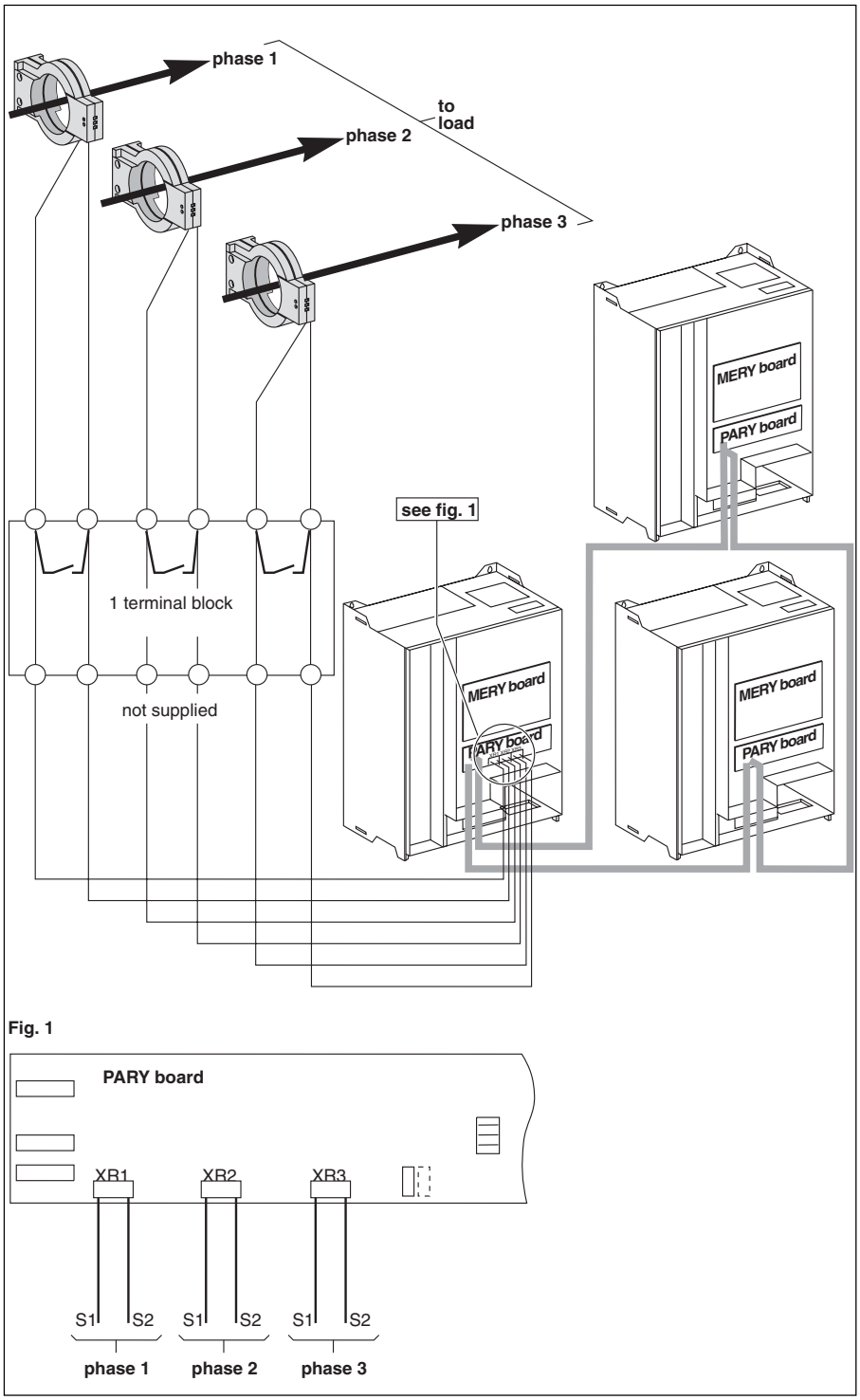


Fig. 1

■ an intermediary terminal block (not supplied) must be installed for the 3 current sensors:
■ it enables each of the 3 secondaries to be short-circuited;
■ one of the control **OSF** conditioners shall be connected to this terminal block;
■ the connection leads supplied with the conditioners will allow the **OSF** conditioners to operate in parallel via a loop communication;
■ other leads supplied with the conditioners will ensure connections between the two cubicles which make up each 120 A.

For 90 A or 120 A parallel units:

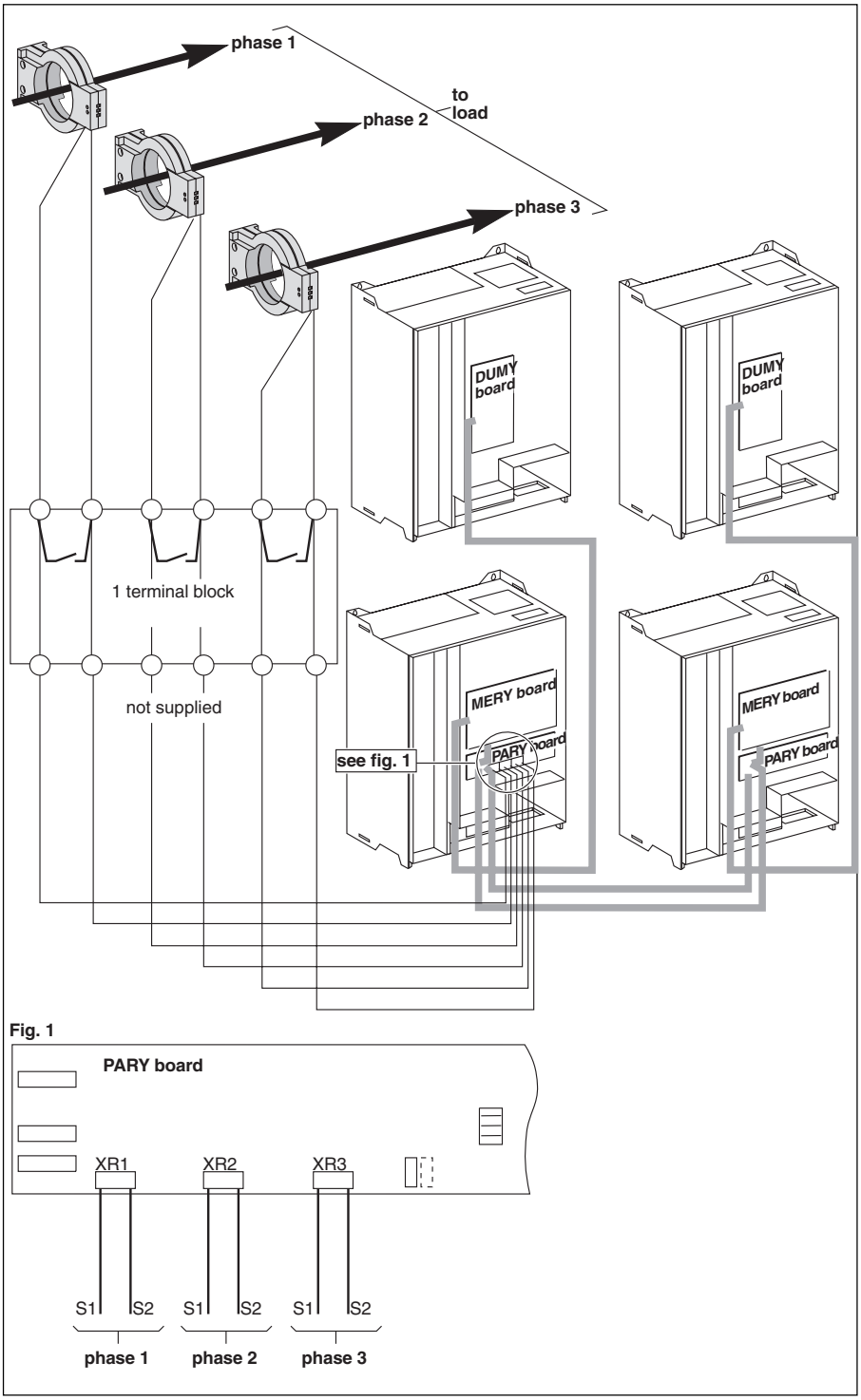


Fig. 1

Connecting sensors

Connection operations

The signal cables connecting the current sensors to the **OSF** conditioner must be moved away from the power cables so that any disturbance is avoided.

Procedure:
■ wiring is connected via the bottom, in front of the conditioner;
■ the signal cables connections are made on 3 screw terminals.

The signal cables must be mechanically fixed near the terminals so that any mechanical stress on the conductors is avoided:
■ put back the protection panels and close the door;
■ close the **OSF** conditioner protection circuit-breaker.

energization and de-energization

The conditioner must be energized for the first time by qualified FRAKO personnel who will carry out the necessary checks to make sure that operation of the installation is optimum.

energization

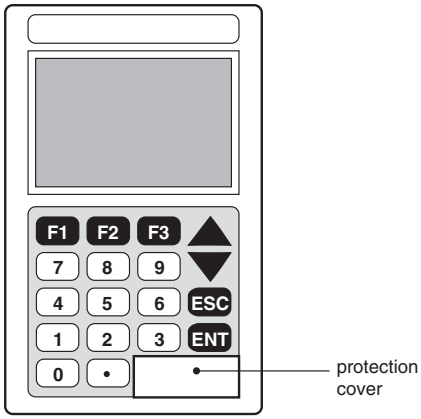
- close the conditioner supply circuit-breaker on your low voltage supply switchboard:

■ the "conditioner stopped" red indicator lamp lights up;
■ the terminal screen lights up;

■ after several seconds, the general menu is displayed on the terminal screen.

general

- if the load harmonic current is higher than the **OSF's** capacity to eliminate harmonics, the orange indicator lamp will flash, whether the conditioner is running or stopped;
- to access the RUN and STOP keys, remove the protection cover located at the bottom of the terminal;
- **OSF** starting and stopping can be controlled manually using the terminal keyboard or via the communication link;
- if **OSF** conditioners are connected in parallel, each conditioner can be started or stopped independently of the others.



starting the SineWave[a] conditioner

- Press the RUN key on the terminal to start the **OSF** conditioner and then confirm the command displayed on the terminal by pressing the ENT key.
- the **OSF** conditioner starts and is then operational. The red indicator lamp goes off and the green lamp lights up.

The **OSF** conditioner will be automatically restarted when energized following disappearance of the utility voltage during operation of the **OSF** conditioner. If it is not energized following the disappearance of the utility voltage, the **OSF** conditioner will remain stopped.

stopping the SineWave[a] conditioner

- to stop the **OSF** conditioner manually, press the STOP key and confirm the displayed command be pressing the ENT key on the terminal;

- the **OSF** conditioner stops and no longer carries out compensation. The green indicator lamp goes off and the red indicator lamp lights up.

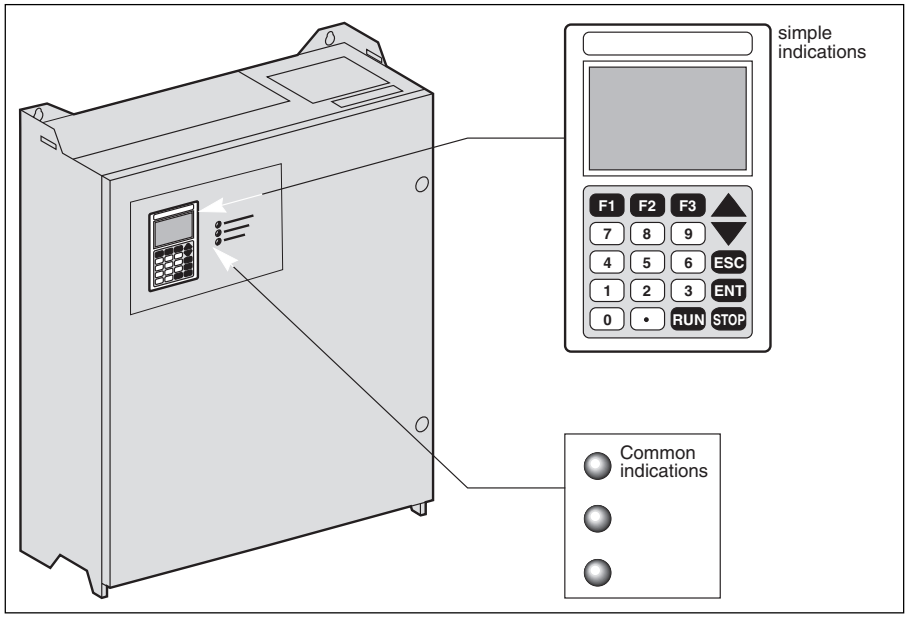
de-energization

The **OSF** conditioner can be de-energized whatever its state: running or stopped.

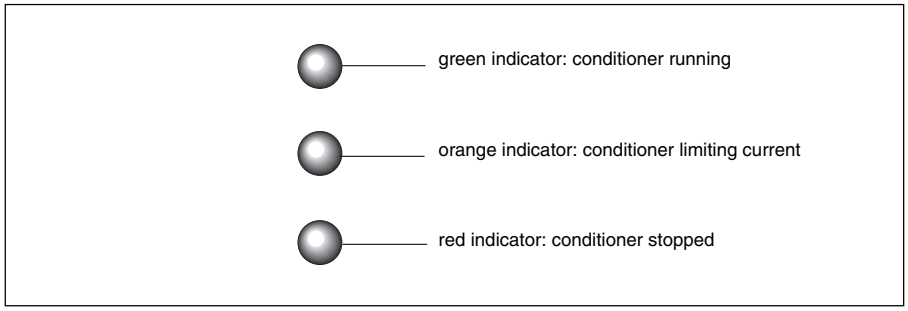
signification of indicator lamps

The conditioner's operating state is given by common indications

User interface



user-friendly interface



These clearly indicate:

- normal operation: green indicator lamp lit.
The **OSF** conditioner is eliminating harmonics on the utility power. This is its normal operating state;
- conditioner stopped: red indicator lamp lit.
The conditioner has stopped following a manual STOP command or an operating anomaly. Consult the user interface to know what the fault is due to and what action to undertake in order to correct the anomaly;
- current-limiting operation: green indicator lamp lit and orange indicator lamp flashing.
The harmonic RMS current absorbed by the load exceeds the **OSF** nominal current. The conditioner thus operates in current-limiting mode:
  - the conditioner limits its compensating current to its nominal current rating (e.g. 30 A RMS for a 30 A **OSF** conditioner),
  - the load is not entirely compensated,
  - the harmonic current difference (load harmonic I - compensating I) remains on the utility power,
  - consult the chapter on "what to do in case of an alarm".

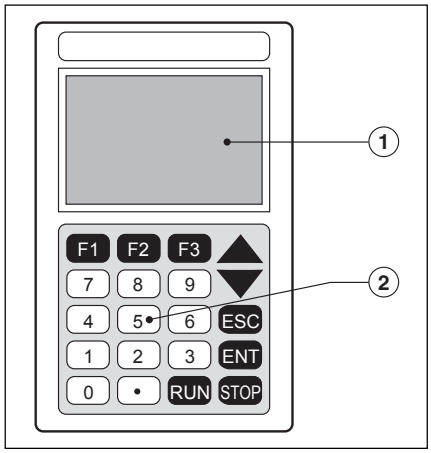
control and monitoring interface

Presentation

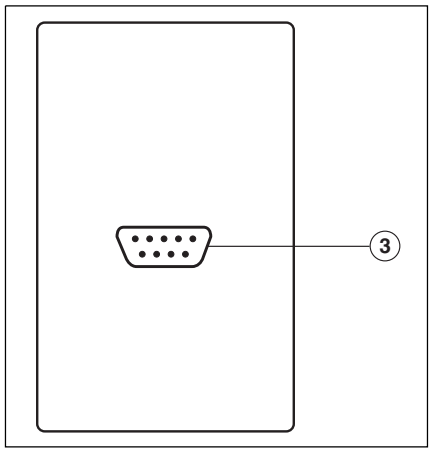
The **OSF** active harmonics conditioner has a highly user-friendly graphic terminal on the front panel which makes the product easy to use. This terminal may optionally be moved to the front panel of a switch board from the conditioner using a separate supply cable.

This terminal allows:
■ the language of the displayed messages to be chosen from a selection of 7 languages;
■ the conditioner identification and operating parameters to be clearly displayed;
■ the **OSF** configuration to be modified to better meet specific applications;
■ conditioner operation to be controlled.

Front view of terminal



Back view of terminal



① Liquid crystal graphic display with back lighting (128 x 64 points, i.e. 6 lines of 21 characters) allowing information to be displayed.

② 20-key keyboard
ENT key (enter)
ESC key (escape)
▲ and ▼ keys
number keys: 0 to 9 and decimal point
function keys: F1, F2, F3
command keys: RUN and STOP protected by a removable protective cover.

③ 9 point SUB-D connector for connecting the terminal to the **OSF** conditioner.

Use

■ **ENT** key:
□ move to following menu,
□ confirmation of a choice;
■ **ESC** key:
□ return to previous menu,
□ cancellation of parameter setting in process and return to original values;
■ ▲ and ▼ keys:
□ scrolling and selection from menu
□ choice of parameter,
□ setting of value (use in + or -)

■ number keys from **0 to 9 and decimal point**
□ entering of passwords,
□ entering of numerical values;
■ function keys **F1, F2, F3**:
□ F1 provides access to the help menu,
□ the functions of F2 and F3 depend on the menu displayed;

■ **RUN** and **STOP** keys
□ RUN: conditioner local RUN command,
□ STOP: conditioner local STOP command.

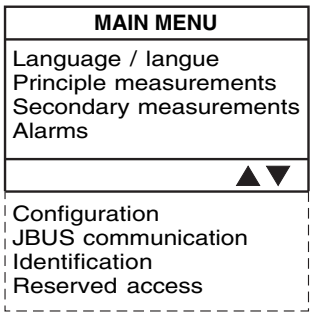
General menu

A menu is a screen offering a list of options and possible choices.
■ to select something from the menu:
□ use the ▲ and ▼ keys to choose the required option,
□ press ENT to confirm the chosen option.

When a menu offers more than 4 options, the presence of the ▼ symbol at the bottom of the screen indicates that the menu continues onto another screen.

The ▲ arrow is used to move back up the menu.

The main menu is automatically displayed when the equipment is energized. It can also be accessed from a sub-menu by pressing ESC several times.



The main menu offers:
Language:
available languages displayed.

Principle measurements:
I r.m.s., load and network THDI, network voltage and **OSF** load rate displayed.

Secondary measurements:
detailed load and network current spectrum displayed.

Alarms:
alarms and level 1 diagnosis displayed, faults acknowledged.

Configuration:
operating parameters modified.

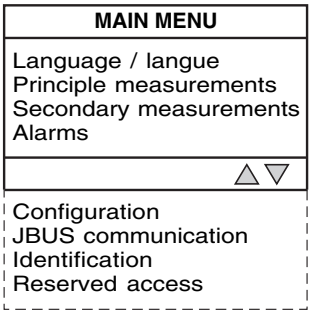
JBUS communication:
communication port parameters modified.

Identification:
main conditioner characteristics and software versions displayed.

Reserved access:
access to FRAKO service personnel only.

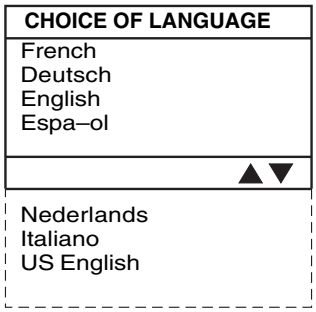
Choice of language

Press ESC several times if necessary to display the main menu.



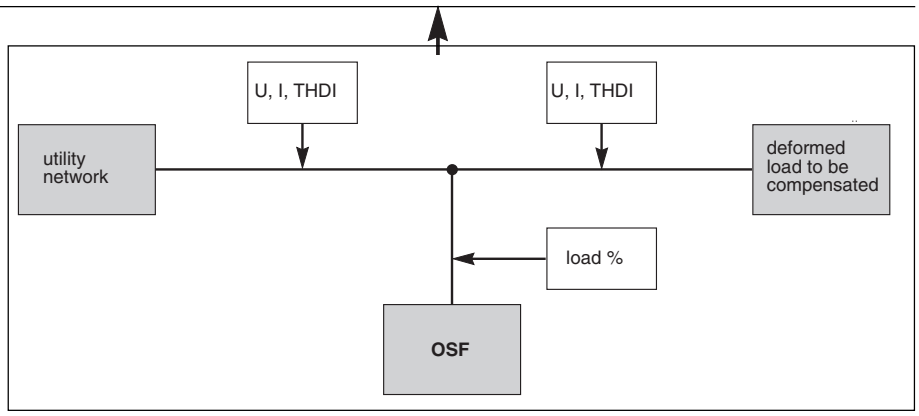
① Choose the **Language** option using the ▲ and ▼ keys. The choice must be displayed in reverse video.

② Confirm the **language** option by pressing ENT.



③ Choose the language using the ▲ and ▼ keys and confirm via ENT

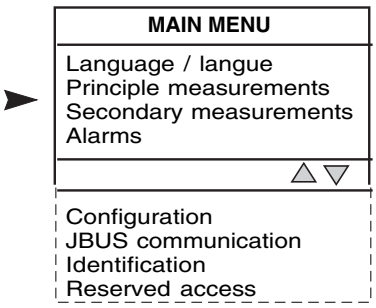
Displaying main measurements
Locating measurement points



Locating measurement points

Using the main menu

Press ESC several times if necessary to display the general menu:



① Choose the **Principle measurements** option using the ▲ and ▼ keys. The choice must be displayed in reverse video.

② Confirm the **Principle measurements** option by pressing the ENT key.

MAINS	LOAD
I1 = xxxA	I1 = xxxA
I2 = xxxA	I2 = xxxA
I3 = xxxA	I3 = xxxA
IN = xxxA	IN = xxxA

▲▼

I1, I2, I3, IN = actual root mean square values in amps of the 3 phases and neutral of the:
- current supplied by the utility power;
- current absorbed by the non-linear load.

The current measurements in the neutral are not displayed in the case of a utility power without distributed neutral.

Insignificant measurements are replaced by * characters on the terminal screen and measurements where the capacity is exceeded are displayed with # characters on the terminal screen.

③ Press the ▲ and ▼ keys to run over the main measurement screens: circular loop display.

MAINS	LOAD
THDI1=xx%	THDI1=xx%
THDI2=xx%	THDI2=xx%
THDI3=xx%	THDI3=xx%
Umains=xxxV	

▲▼

THDI1, THDI2, THDI3 = distortion rates of the 3 phases (THDI = I-harmonic/I-basic) of the:
- current supplied by the utility power;
- current absorbed by the non-linear load.

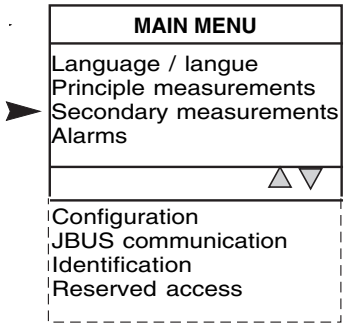
Umains = average value of the 3 utility network phase-to-phase voltages.

LOAD LEVEL SINEWAVE
I1 / In = xxx%
I2 / In = xxx%
I3 / In = xxx%

▲▼

I1/In, I2/In, I3/In = **OSF** active conditioner load rates on each of the phases.
I1 = root mean square current supplied by the conditioner on phase 1,
In = nominal root mean square current.

Displaying secondary measurements



① Choose the **Secondary measurements** option using the ▲ and ▼ keys.

② Confirm the **Secondary measurements** option by pressing the ENT key.

I1 LOAD SPECTRUM	
H1 = xx%	H9 = XX%
H3 = xx%	H11 = xx%
H5 = xx%	H13 = xx%
H7 = xx%	THDI = xx%
I2 I3	▲▼

H1, H3 - H13 = detailed spectrum of first 13 harmonic orders.
THDI = total harmonic distortion rate of the current absorbed by the load.

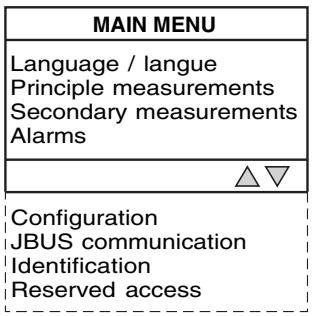
③ Press ▲ and ▼ arrows to display the detailed spectrum of the current supplied by the utility power.

I1 MAINS SPECTRUM	
H1 = xx%	H9 = XX%
H3 = xx%	H11 = xx%
H5 = xx%	H13 = xx%
H7 = xx%	THDI = xx%
I2 I3	▲▼

H1, H3 - H13 = detailed spectrum of first 13 harmonic orders.
THDI = total harmonic distortion rate of the current supplied by the utility power.

④ Press the function keys F2 and F3 to display phase 2 and phase 3 currents.

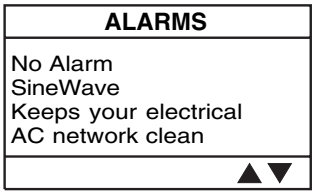
Displaying alarms



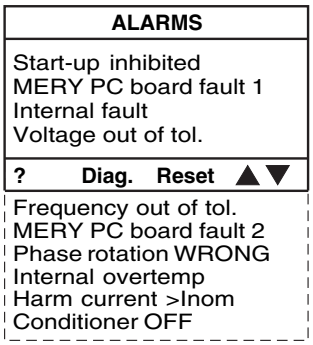
① Choose the **Alarms** option using the ▲ and ▼ keys. The choice must be displayed on the screen in reverse video.

② Confirm the **Alarms** option by pressing the ENT key.

The following screen is displayed during normal operation: conditioner running and no anomaly present.



In the event of an operating anomaly, the following screen is displayed with the active alarms only.



The ▲ and ▼ keys allow 2 pages of faults to be displayed. The F2 "Diag" key provides access to the level 1 diagnosis and the F3 "Reset" key allows memorised faults to be acknowledged.

List of alarms displayed:

MERY PC board fault 1: the main control and monitoring board is faulty. The board must be replaced by the FRAKO after-sales service.

Internal fault: this message informs the user of an internal conditioner fault which requires intervention by the FRAKO after-sales service.

Voltage out of tol.: the amplitude of the utility network voltage is out of the permitted limits. Check the presence and amplitude of the utility power 3 phases and neutral. The voltage tolerances permitted are defined in the section on "characteristics and performances".

Frequency out of tol.: the utility power frequency is out of the permitted limits. Check the utility power frequency. The frequency tolerances permitted are defined in the section on "characteristics and performances".

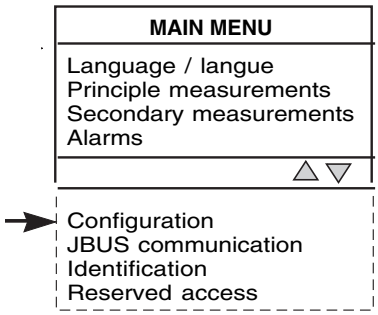
MERY PC board fault 2: the main control and monitoring board is faulty. The board must be replaced by the FRAKO after-sales service.

Internal overtemp: the conditioner has been stopped by the thermal protection thus avoiding damage to the equipment. Check that the 3 ventilators are operating correctly, that the air vents are clean and check the temperature of the room. The temperature tolerances permitted are defined in the paragraph on "characteristics and performances".

Harm current > I nom: the harmonic root mean square current absorbed by the load exceeds the **OSF** conditioner nominal current making it operate in current-limiting mode.
- the conditioner limits its compensating current to its nominal current rating (e.g. 30 A root mean square for a 30 A **OSF** conditioner);
- the load is not entirely compensated;
- the harmonic current difference (load harmonic I - compensating I) remains on the utility power;
- problems may occur in your installation depending on the rate of harmonics remaining on the utility power;
- consult the FRAKO after-sales service.

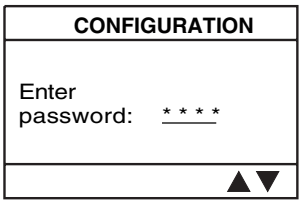
Configuring

The configuration of the conditioner carried out in the factory will be checked when the conditioner is first energized, and must not be further modified. Only qualified FRAKO personnel are allowed access.



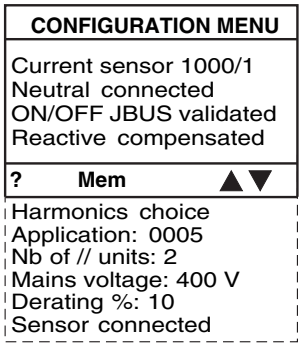
① Choose the **Configuration** option using the ▲ and ▼ keys.

② Confirm the **Configuration** option by pressing the ENT key.



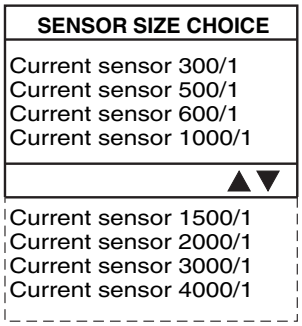
③ Enter the password (4 characters) then press ENT.

The password characters are displayed by an "*".



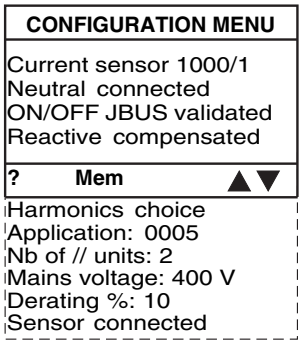
④ Choose the parameter to be modified using the ▲ and ▼ keys and press ENT.

For example, modification of the rating of the sensors used to measure load currents.



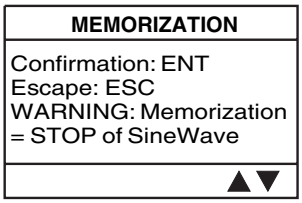
⑤ Choose the sensor rating using the arrows and press ENT.

The Configuration Menu screen is again displayed for modification of other parameters if required

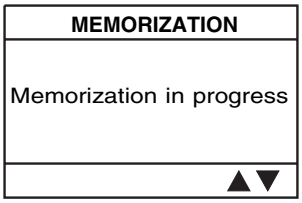


⑥ Press F2 "Mem" key to memorise the new parameters.

The screen opposite is displayed after pressing F2 to confirm memorisation of the new parameters



⑦ Confirm memorization by pressing ENT or cancel modifications in progress by pressing ESC.



This screen is displayed while the parameters are being saved, wait a few seconds for the general menu to be displayed before starting the **OSF** up again.

Configuration parameter lists

Sensor rating: choose the rating of the sensors used to measure the load currents.

Type of utility power: utility power with or without distributed neutral.

RUN/STOP authorisation via JBUS communication port: authorisation or non authorisation of remote RUN and STOP commands via the JBUS communication port.

Reactive compensation or no reactive compensation:
compensation or no compensation of the reactive energy. If this option is confirmed the amount of reactive energy supplied by the network can be reduced and penalty payments in preferential tariff contracts avoided. Compensation is optimised increasing the value of cos to a value higher than or equal to 0.94. Reactive energy compensation is carried out to the detriment of harmonic compensation and it is therefore necessary to oversize the conditioner if it is required to compensate both reactive energy and harmonics.

Choice of compensated harmonic orders:
if this option is selected, the harmonic orders to be compensated, in order to optimise conditioner performance, can be chosen.

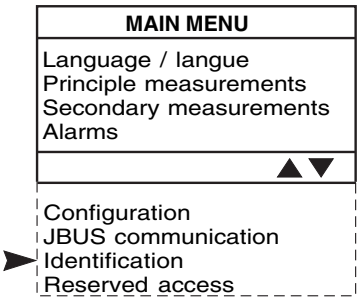
Choice of application type: the choice of application type is a parameter which is set in the factory. It is defined in relation to the customerÕs installation configuration.

Number of parallel-connected devices.
Utility power voltage: load supply voltage
Derating: depending on altitude.

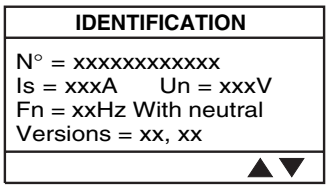
J-BUS communication

Parameter setting of the communication port is described Is the specific J-BUS communication port manual.

Identification



① Choose the **Identification** option using the ▲ and ▼ keys.
② Confirm the **Identification** option by pressing the ENT key.

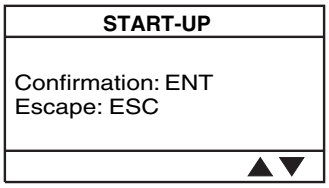


This screen displays the device serial number, the nominal current in amps, the nominal voltage in volts, the nominal frequency in Hz, the type of network (with or without distributed neutral) and the software versions built into the control and monitoring board.

③ Press ESC to return to the general menu.

RUN - STOP commands

① Press RUN to start the device or STOP to stop the device.



This screen allows the command to be confirmed by pressing ENT or cancelled by pressing ESC.

Reserved access

This command provides access to the centre of the system and is for FRAKO personnel only so that
they may carry out a detailed survey of the conditionerÕs internal operation.

maintenance
what to do in case of an alarm

maintenance

Before any intervention:
■ in the **OSF** conditioner:
switch off the power supply and wait for the capacitors to discharge (5 min.);
■ on the current sensor connection:
short-circuit the sensor secondaries.

The **OSF** harmonics conditioner does not require any preventive maintenance.
It is nevertheless advisable to carry out the following at regular intervals:
■ **clean the air vents and check that ventilation is efficient**;
■ check the state and tightness of connections;
■ make sure that the temperature of the air at the **OSF** conditioner inlet is below 40 degrees.

what to do Is case of an alarm

symptoms	corrective actions
terminal and indicator lamps off	check the voltage at the **OSF** conditioner input. The voltage tolerances permitted are defined in the section on "characteristics and performances".
terminal OFF	check that the graphic terminal is plugged in.
MERY PC board fault 1	ask the FRAKO after-ales service to intervene.
MERY PC board fault 2	ask the FRAKO after-ales service to intervene.
internal fault	ask the FRAKOafter-ales service to intervene.
voltage out of tol.	check the voltage at the conditioner inlet. The voltage tolerances permitted are defined in the section on "characteristics and performances".
frequency out of tol.	check the frequency at the conditioner inlet. The voltage tolerances permitted are defined in the section on "characteristics and performances".
internal overtemp	check ventilator operation, the temperature inside the room and the cleanliness of the air vents. The temperature tolerances permitted are defined in the section on "characteristics and performances".
orange indicator lamp flashing	the conditioner is limiting current because the installation's compensation need is higher than the current that the conditioner can supply. The conditioner automatically protects itself. Compensation is not total.

Reliable energy solutions.

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technical reference base: active conditioner characteristics (07/03/97 version)

Unless otherwise stipulated, the performances given Is the table below are typical values corresponding to use under a nominal utility power voltage of **400 V** three-phase, at **50 Hz**, at the **nominal current.**

network input	■ nominal voltage	☐ 400 V -20% + 15%
	■ nominal frequency	☐ 50 Hz, 60 Hz +/- 4 Hz
	■ number of phases	☐ 3 phases with or without distributed neutral, operation possible on single-phase or unbalanced loads.
functions	■ harmonic compensation	☐ global or order by order
	■ power factor compensation	
	■ cosine compensation	☐ possible to set parameters
operating mode	■ single	
	■ connected in parallel	☐ up to 4
technical characteristics	■ compensation capacity per phase	☐ 20 A r.m.s ☐ 30 A r.m.s ☐ 45 A r.m.s ☐ 60 A r.m.s ☐ 90 A r.m.s ☐ 120 A r.m.s **note:** the compensation capacity decreases with the frequency of the harmonic orders to be compensated.
	■ compensation capacity in neutral conductor	☐ 60 A r.m.s. ☐ 90 A r.m.s. ☐ 135 A r.m.s. ☐ 180 A r.m.s. ☐ 270 A r.m.s. ☐ 360 A r.m.s.
	■ compensated harmonic orders	☐ H2 to H25 (parameter setting possible) global or selective compensation
	■ dynamic capacity in dI/dt:	☐ > 100 kA/s for 20 A and 30 A ☐ > 200 kA/s for 45 A and 60 A ☐ > 400 kA/s for 90 A and 120 A
	■ response time	☐ 40 ms
	■ reduction rate	☐ load THDI /network THDI > = 10 at the conditioner nominal current if load THDI > 40%; ☐ network THDI > 4% at the conditioner nominal current if load THDI < 40% Global compensation reduction rate THDI = I_harmonic/I-basic.
	■ overload	☐ limiting to nominal current continuous limiting operation possible.
	■ inrush current	☐ < nominal current without matching transformer
	■ losses	☐ < 1000 W at 20 A < 1200 W at 30 A ☐ < 1900 W at 45 A < 2400 W at 60 A ☐ < 3800 W at 90 A < 4800 W at 120 A
	■ ventilation	forced air (inlet via bottom and outlet via top) 1000 m^3/h for 20 to 60 A ratings, 2000 m^3/h for 90 to 120 A ratings.
	■ acoustic noise according to ISO 3746	☐ < 58 dBA at 20 A ☐ < 59 dBA at 30 A ☐ < 62 dBA at 45 A ☐ < 64 dBA at 60 A ☐ < 65 dBA at 90 A ☐ < 67 dBA at 120 A At the nominal current on computer load according to ISO 3746.
environmental conditions	■ ambient temperature	☐ 0 a 40°C permanently
	■ rate or relative humidity	0 to 95 % relative humidity without condensation.
	■ operating altitude	< 1000 m without derating, above this derating of 10% per additional 1000 m.

configuration	■ language	☐ French, English, German, Italian, Spanish, Dutch, American
	■ type of utility power	☐ with or without Neutral
	■ sensor ratings	☐ closed sensors: 300/1, 500/1, 1000/1, 1500/1, 2000/1, 3000/1, 4000/1 ☐ opening sensor: 600/1, 2000/1
	■ reactive compensation	☐ YES or NO
	■ remote RUN/STOP confirmation	☐ YES or NO
	■ choice or compensated orders	☐ Hn = YES or NO
	■ communication parameters	☐ speed, format, parity, nb stop bits, address
	■ type of application	☐ 0 to 5
	■ number of parallel conditioners	☐ 1 to 4
	■ derating In relation to altitude	☐ 0 to 100%
	■ utility power voltages	☐ 208 V, 220 V, 240 V, 400 V, 460 V, 500 V, 575 V, 700 V
display	■ front panel	☐ green led = normal operation ☐ red led = conditioner OFF ☐ orange led = inverter in limitation
	■ display	☐ display of measurements and alarms ☐ implementation guide, diagnosis ☐ entry of customer parameters
commands	■ front panel keypad	☐ conditioner RUN push-button ☐ conditioner STOP push-button
remote transfers	■ 3 voltage-free changeover dry contacts	☐ 2 x conditioner running/stopped ☐ 1 x limiting operation
dimensions and weight	■ height (overall)	☐ 680 mm - 20 A, 30 A ☐ 780 mm - 45 A, 60 A ☐ 2 x 780 mm + 250 mm - 90 A, 120 A
	■ unit height	☐ 620 mm - 20 A, 30 A ☐ 720 mm - 45 A, 60 A ☐ 2 x 720 mm + 250 mm - 90 A, 120 A
	■ width	☐ 540 mm - 20 A, 30 A ☐ 590 mm - 45 A, 60 A ☐ 590 mm - 90 A, 120 A
	■ depth	☐ 280 mm - 20 A, 30 A ☐ 325 mm - 45 A, 60 A ☐ 325 mm - 90 A, 120 A
	■ weight	☐ 65 kg - 20 A, 30 A ☐ 110 kg - 45 A, 60 A ☐ 220 kg - 90 A, 120 A
colour	■ standard	RAL 9002 (light grey)
reference standards	■ safety construction	EN 50091-1
	■ design	IEC 146
	■ protection	IEC 529, NFC 20010
electromagnetic compatibility	■ conducted and radiated emissions	EN 55011 level A
	■ testing and measuring techniques	IEC 1000-4-1
	■ testing immunity to electrostatic discharges	IEC 1000-4-2 (IEC 801-2) level 3
	■ testing immunity to radiated fields	IEC 1000-4-3 level 3 (12 V/m)
	■ testing immunity to fast transients voltage bursts	IEC 1000-4-4 (801-4) level 4
	■ testing immunity to surge voltage	IEC 1000-4-5 level 4 in differential mode level 4 in common mode
	■ testing immunity to conducted disturbances induced by electrical radio fields	IEC 1000-4-6 level 3 (12 V)

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Quality has a Name
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