

I N F R A N O R

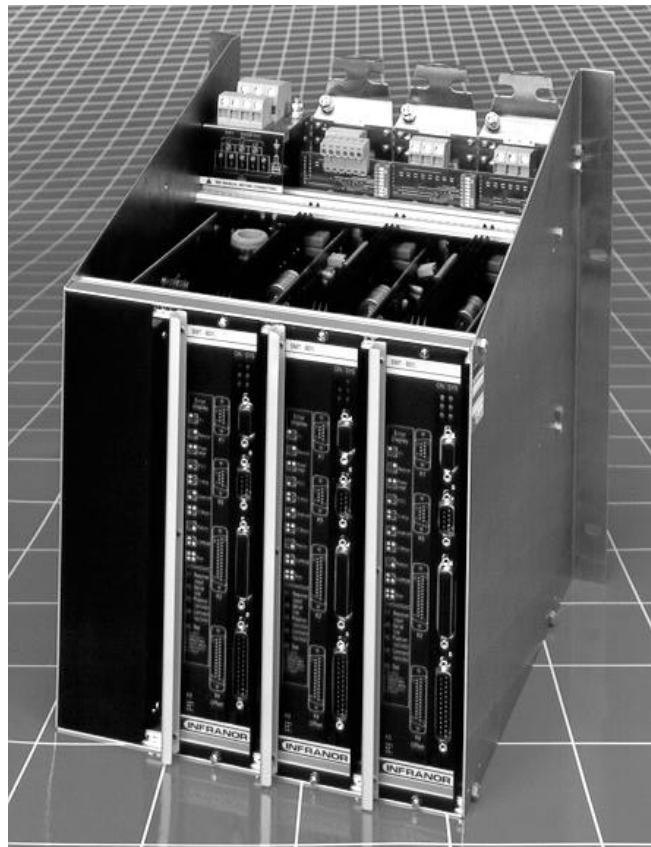
OPERATING MANUAL

SERIES R B F

BRUSHLESS RACK SYSTEM

Version 3.0

(European version 1.3)



This is a general manual describing a series of racks receiving Servo Amplifiers having output capability suitable for driving Brushless Servo Motors. This manual may be used in conjunction with appropriate and referenced drawings pertaining to the various specific models. Maintenance procedures should be attempted only by highly skilled technicians using proper test equipment. Read your warranty provision carefully before attempting to adjust or service the unit.

RECEIVING AND HANDLING

Upon delivery of the equipment, inspect the shipping containers and contents for indications of damages incurred in transit. If any of the items specified in the bill of lading are damaged, or the quantity is incorrect, do not accept them until the freight or express agent makes an appropriate notation on your freight bill or express receipt.

Claims for loss or damage in shipment must not be deducted from your invoice, nor should payment be withheld pending adjustment of any such claims.

Store the equipment in a clean, dry area. It is advisable to leave the equipment in its shipping container until ready for use. Each amplifier is checked carefully before shipment. However, upon receipt, the user should make sure that the amplifier received corresponds to or is properly rated in terms of rated voltage and current for the type of motor which is to be driven. The descriptive label affixed to the amplifier specifies electrical ratings.

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**OPERATING MANUAL
INFRANOR
SERIES RBF
BRUSHLESS RACK SYSTEM
(March 1998)**

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1.0.0 GENERAL

1.1.0 Introduction

The RBF rack system is designed for the Infranor brushless amplifier SMTBSI and SMTBD Series independently of the different amplifier current rating. The power bus voltage is “floating” and is not connected to the chassis, therefore allowing a transformerless operation.

The power supply is integrated into the rack on the left side flange which act as an heat sink. Motor and power supply connections are in the rear of the rack for better noise immunity.

A shunt regulator system is also part of the power supply. Four different power dissipations are available, depending upon the energy regenerated by the system.

1.2.0 Special features

- 6 axis in a standard 19" rack, height = 355mm, depth = 285mm.
- 35ADC or 70ADC DC bus power supply available. (90ADC on request)
- Transformerless operation (inductors may be required)
- Fan cooling for optimum heat dissipation.
- Optional shunt regulator modules available.
- Rear rack mounting.
- Easy amplifier plug-in connections.
- Terminal strip connector over the rack.
- Standard auxiliary input voltage for logic supply.

2.0.0 SPECIFICATIONS

2.1.0 Technical specifications for RBF Rack Series

The RBF rack Series can accept up to 6 axis (<60ARMS) including one DC bus power supply.

Depending upon the amplifier maximum continuous current, it will be necessary to allocate one and half or two axis for one module due to a larger heat sink size:

- < = 60 ARMS = 1 Axis width
- < = 60 ARMS with heatsink = 1.5 Axis width
- > = 70 ARMS = 2 Axis width

Main Power Supply

The main DC power supply has a rating of 35 ADC or 70 ADC. It will be necessary to calculate the continuous rms current of the overall system in order to properly size the current rating. An optional 90ADC power supply is available on special request.

The use of an isolation transformer is not necessary, however, an autotransformer can be used to step up/down the voltage. A line inductor will be mandatory if direct line (220VAC) is used.

Note:

- Amplifier with current higher than 60Arms require a width of 2 axis.
- A heatsink can be mounted on the amplifier module increasing the width to 18TE.
- A fan is required depending upon the amplifier RMS current rating. They are mounted on top of the rack. One fan can cool up to 2 axis of 60A and smaller or 1 axis of 70A and higher. The input voltage is applied to the auxiliary supply input (XA2).

2.2.0 **Technical specifications for shunt regulator**

Several shunt regulator circuits are available, depending on the energy regenerated by the system. We do recommend to consult Infranor for proper sizing of this device.

Four shunt regulators can be integrated with the RBF rack series as follows:

<u>Type</u>	<u>Continuous Power</u>	<u>Peak Power</u>	<u>Shunt Resistors</u>	<u>RBF 35</u>	<u>RBF 70</u>	<u>RBF 90</u>
D	140	10000	inside	STD	NA	NA
D2	280	16000	side flange	OPT	STD	STD
E	560	20000	external resistors	NA	OPT	OPT
D1	1100	42000	external resistors	NA	OPT	OPT

Type D:

A resistor of 15Ω /140W is mounted on the inner left side flange of the RBF rack. This version is standard if not specify otherwise on the RBF-35 rack version.

Type D2:

A resistor of 10Ω / 280W is mounted on the outer left side flange of the rack with a finger guard cover. The overall width of the RBF rack will increase by about 30mm (1.2in). This version is standard if not specify otherwise on the RBF-70 rack version.

Type E:

Two resistors of 15Ω / 280W are mounted by the customer via two connectors placed on the rear of the rack. An IGBT transistor is used allowing higher dissipated power. These resistors have to be wired in parallel to allow a dissipation of 560W continuous.

Type D1:

This model is made of two braking systems type E connected via three connector on the rear of the rack. It is suggested to mount this assembly outside the electrical cabinet to allow proper cooling. See chapter 4.6.0 for dimensions

2.3.0 Amplifier current table for continuous cycle

MODEL	Un Veff	IMAX 1sec		Inom (Aeff)			SIZE
		SMTBD	SMTBSI	WITHOUT FAN	FAN 1	FAN 2	
SMT-BSI-220/08	240	8.8	8	4			12TE
SMT-BSI-220/12	240	13.8	13	6			12TE
SMT-BSI-220/17	240	17.7	17	8,5			12TE
SMT-BSI-220/30	240	30.8	29	8,5	12	15	12TE
SMT-BSI-220/30r	240	30.8	29	10	15		18TE
SMT-BSI-220/45	240	48.6	46	8,5	15	18	12TE
SMT-BSI-220/45r	240	48.6	46	10	20	23	18TE
SMT-BSI-220/60	240	61	58	8,5	17	20	12TE
SMT-BSI-220/60r	240	61	58	12	26	30	18TE
SMT-BSI-220/70 ¹	240	70	70	17	30	35	24TE
SMT-BSI-220/100 ¹	240	100	100	25	30	35	24TE

¹Mechanical width is double (24TE)

Fan 1 = 115CFM Fan 2 = 220CFM

Note: The models with an “r” are equipped with an heatsink, therefore the mechanical width is increased from 12TE to 18TE (see chapter 4.1.0 for dimensions)

3.0.0 CONNECTIONS

3.1.0 Principles

It is very important to follow some precautions to avoid ground loops around the zero volt logic supply or noise disturbances in order to obtain good results. Here are a few points to pay special attention:

- Every conductor cable (carrying a potential) **MUST** be shielded.
- Two or more wires in the same sleeve **MUST** be twisted pair and shielded.
- A shield not carrying a potential can be connected at both ends with a “360°” clamp connection (shield to be connected over the whole circumference of the cable by a clamp).
- The reference of potential **IS** connected to earth ground.
- Cable with low potential should **NEVER** run in the proximity of power lines.
- Long reference potential leads is suitable **ONLY** if these loops have a very low impedance (<0.1 ohm).
- A shielded cable has **NO** effect if it is not connected:
 - to a reference potential
 - by a short length to a reference potential (few inches)
 - by a 360° shielded connection.
- If a reference of potential is existing like a main chassis or a cabinet with a low impedance between the different elements of its volume, it should be used to connect all reference to it and also connect this reference to the earth.

3.2.0 RBF back panel connections

JUMPER	INHIBIT	AMP. READY	IDYN (option)	POWER OK D/R OK
"A" closed on last axis Switches G and H "ON"		Serial		
"A" closed on each axis Switches G and H "OFF"		Independent		
"B" closed on last axis Switches E and F "ON"				Serial
"B" closed on each axis Switches E and F "OFF"				Independent only available on connector X5
"N" closed on last axis Switches O and P "ON"			Serial	
"N" closed on each axis Switches O and P "OFF"			Independent	
Switch D "ON"	Serial			
Switch D "OFF"	Independent			

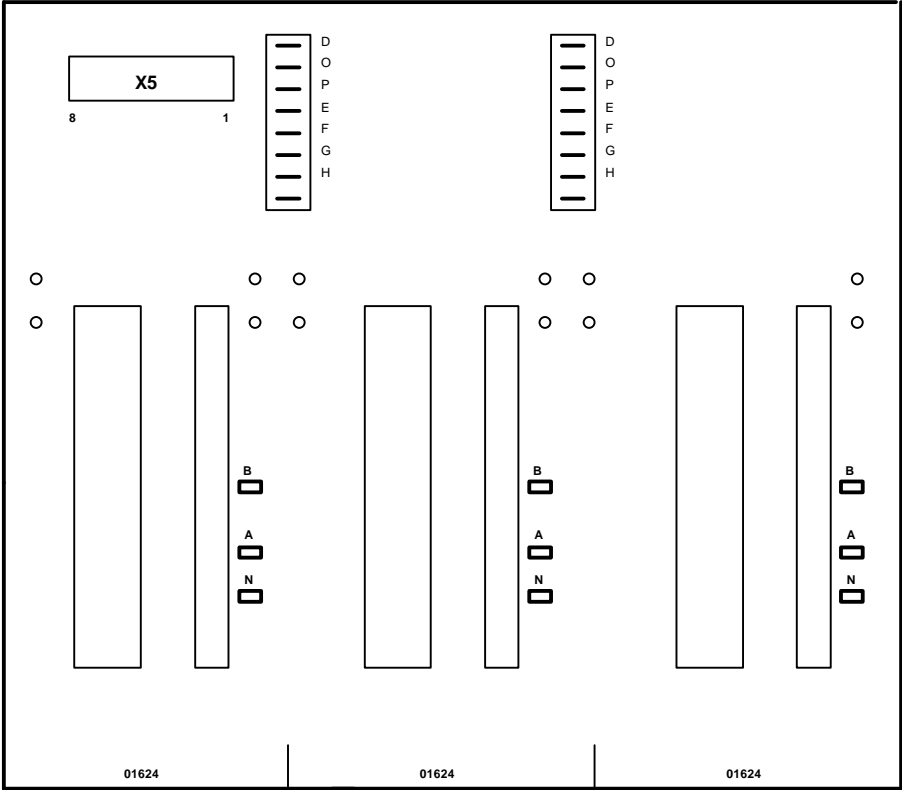
In standard, all these signals are wired in **series**. Consequently, the jumpers **A**, **N**, **B** are closed on the last axis

3.2.1 X5 - Common signals connector (8 points orange)

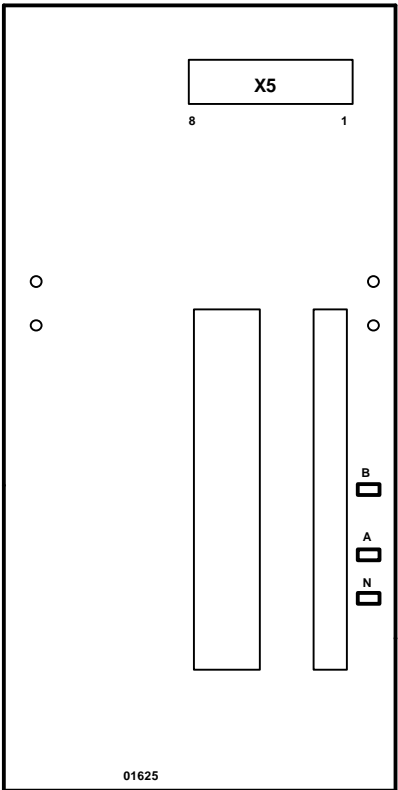
Pin	Function	Remarks
1	Common Inhibit	Enable to 0 Volt, disable if open
2	0 Volt Inhibit	
3	Power ready + D/R OK	All relay contacts of each axis in series if one fails, relay opens
4	Power ready + D/R OK	
5	Amplifier ready	All relay contacts of each axis in series if one fails, relay opens
6	Amplifier ready	
7	Idyn limitation (option)	All relay contacts of each axis in series if Idyn limitation occurs, contact relay opens
8	Idyn limitation (option)	

- See amplifier operating manuals for more details on the function of these signals.
- Relay output specifications is rated at 50V, 100mA

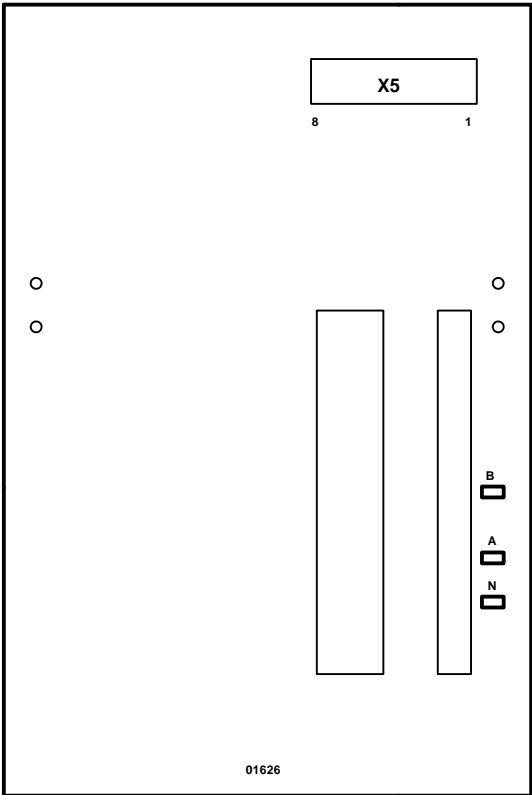
3.2.2 RBF back panel diagram



BACK PANEL 12TE

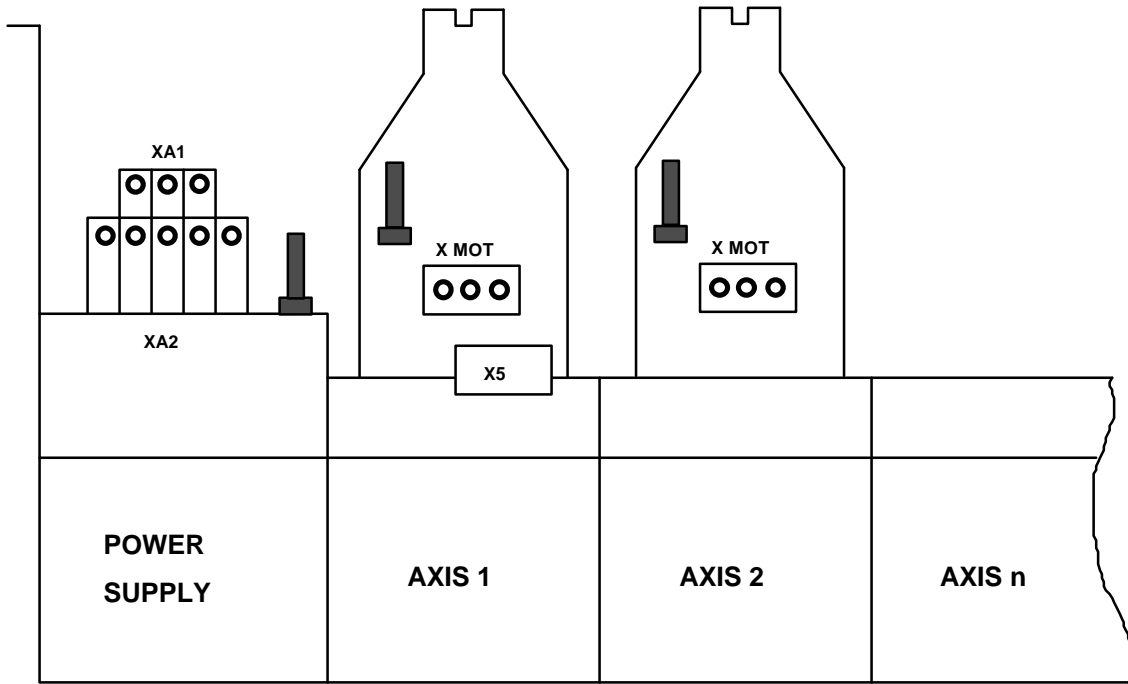


BACK PANEL 18TE



BACK PANEL 24TE

3.3.0 Power connections



3.3.1 Power supply connector XA1 - XA2

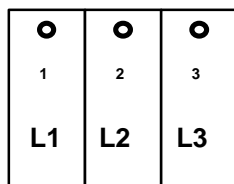
The power supply connector includes the main line input XA1, the auxiliary and/or fan(s) input XA2 and the connections for the braking resistor(s) according to the option (D1 or E option).

3 phase 220 VAC

Maximum section: 16 mm² (AWG 6)

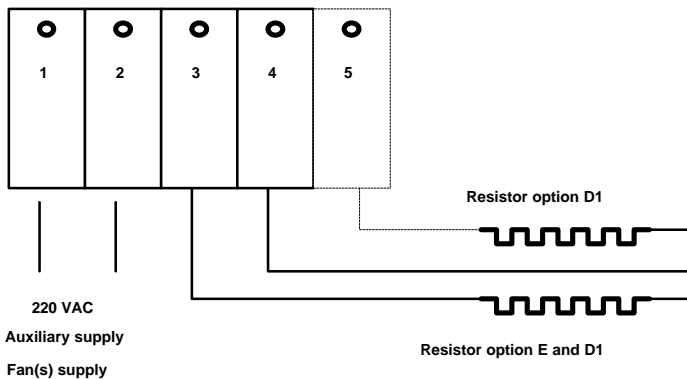
Maximum continuous current: 82 A

XA1



Earth/Ground: Screw 5 mm

XA2



3.3.2 Motor connection

EACH MOTOR HOUSING MUST BE CONNECTED TO EARTH GROUND (resistance <0.1 ohms). These connections must be independent of the main power supply voltage.

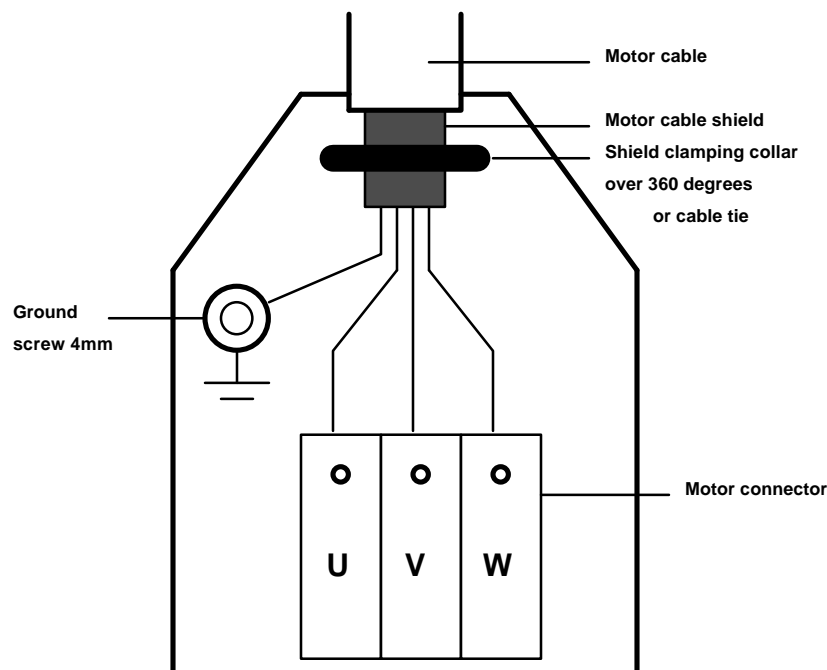
Motor cables must be shielded to avoid the effects of common mode.

The recommended cable is a four wires shielded (Mavilor p/n 410-0051, 410-0052, Belden p/n 9367).

Each motor shield must have a "360°" connection on the motor connector side **AND** on the clamp provided in the Infranor rack chassis. This will be in accordance with the electromagnetic requirement of IEC 801.

The motor cable cannot run in the proximity of the resolver or command cables.

The motor cable gauge must be adapted to the rating of the amplifier continuous current.



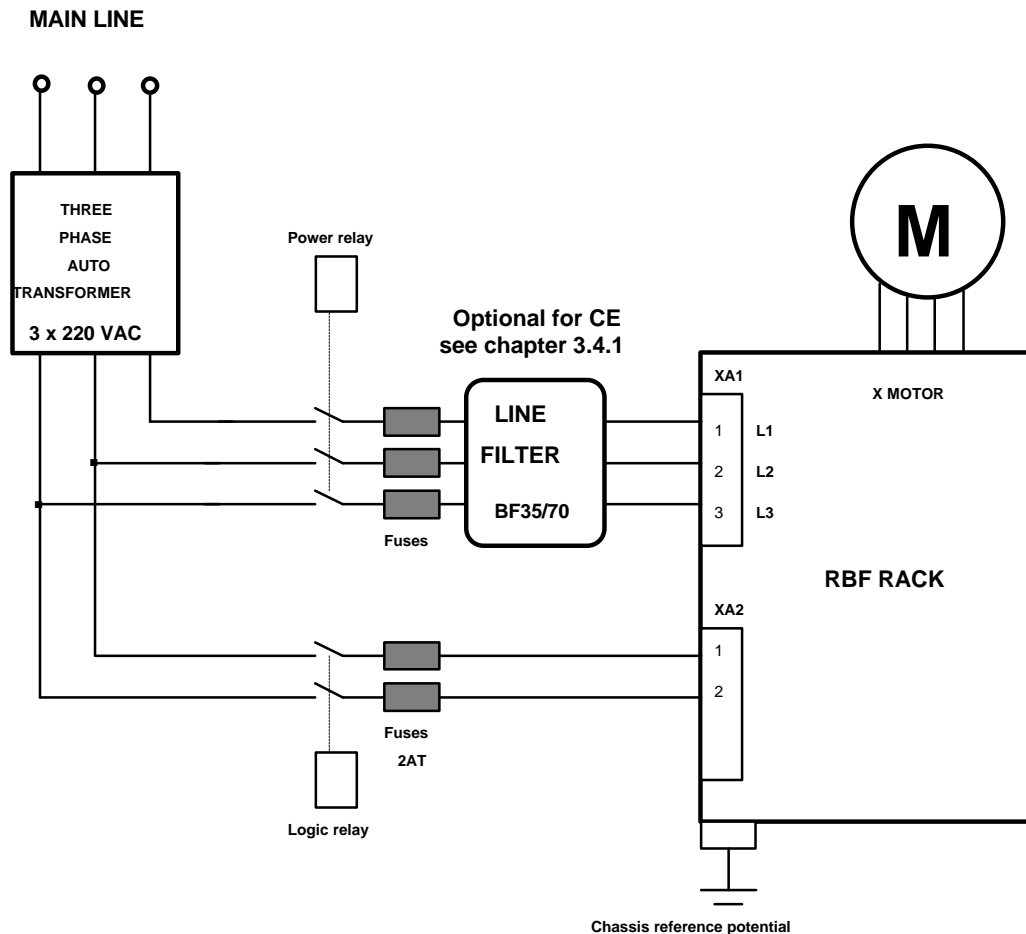
Maximum section: 6 mm² (AWG 10)

Maximum continuous current: 44 Arms

3.4.0 Three phase connection via autotransformer

The main three phase input line voltage is rated at 220 VAC, therefore an autotransformer or an isolation transformer is required if other voltage are available at the main line voltage. Contact Infranor Inc for appropriate transformer sizing.

The auxiliary voltage must ALWAYS be connected between two of the 220 VAC line phase (see diagram below).

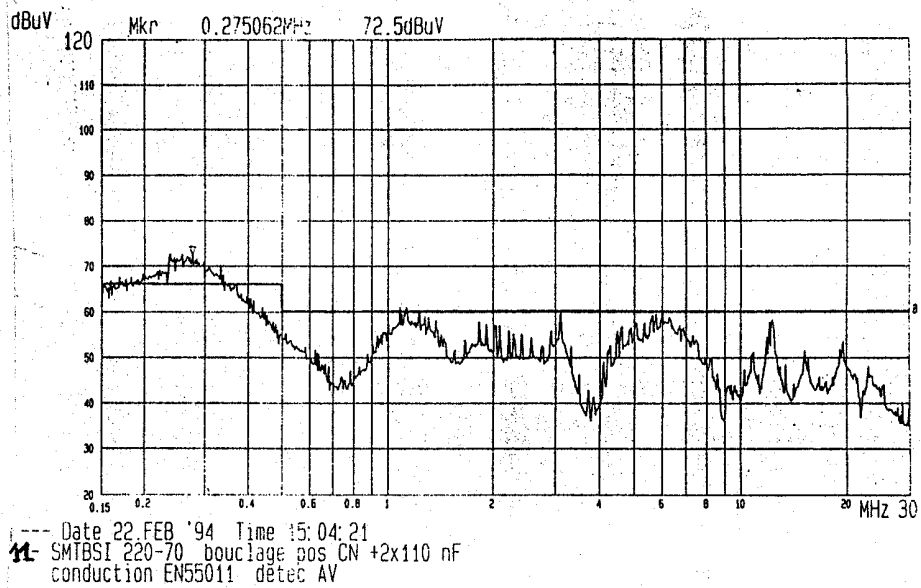


- All supply line voltage must ABSOLUTELY be connected through a relay contactor to cut all lines at the same time (main power and auxiliary supply).
- The “logic relay” **MUST BE** activated before the “power relay” (minimum 2sec.)
- The grounding of the RBF rack is MANDATORY in order to avoid any physical damages in case of insulation failure.
- Infranor recommend the use of a differential circuit breaker to control any insulation failure to earth ground.
- See chapter 4.5.0 for autotransformer specifications and dimensions.

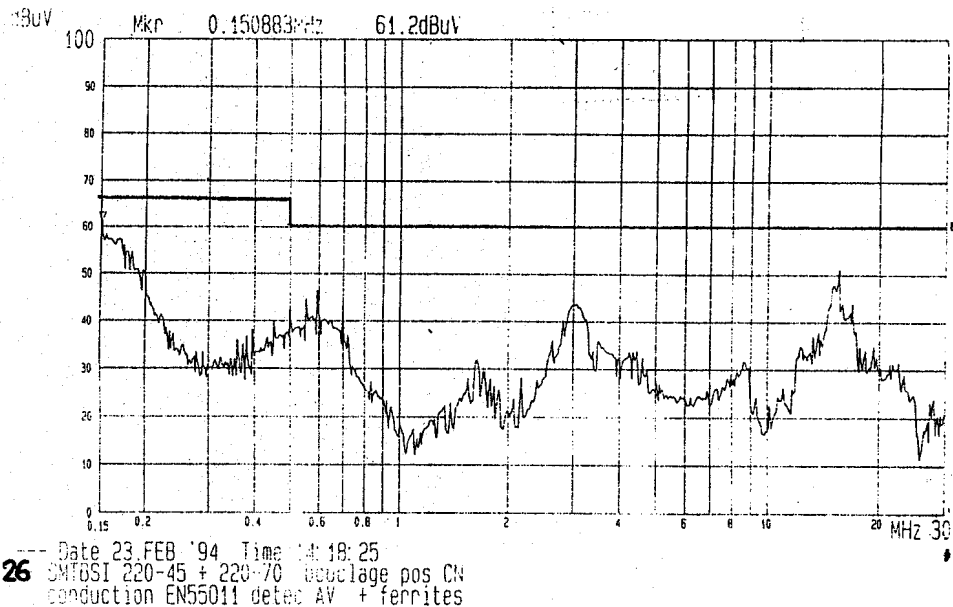
3.4.1 Main line three phase filter

In order to comply with the electromagnetic standard EN 55011 group 1 class A with autotransformer usage and the CE specifications, it is necessary to add a three phase line filter as shown in diagram chapter 3.4.0.

The two curves below shows the frequency response without line filter (curve no. 11) and with line filter (curve no. 26).



Curve no.11



Curve no.26

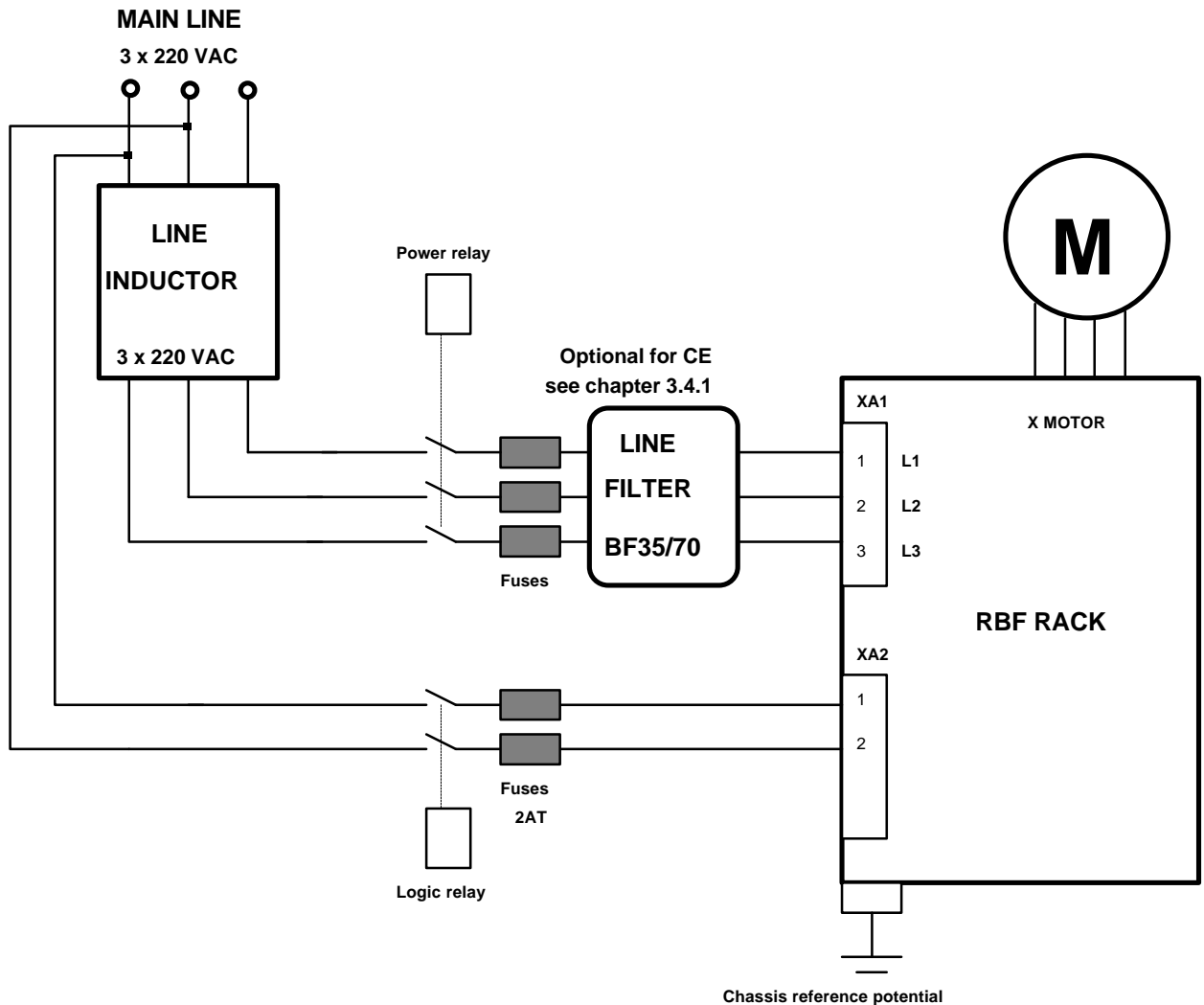
The line filter must be connected as close as possible to the RBF rack (max. 30cm). A metal braid must connect the filter ground terminal to a fastening screw of the RBF rack to maintain equipotentiality.

Two current rating line filter are available, that is the **BF35** for the RBF-35 and the **BF70** for the RBF-70.

3.5.0 Three phase connection without autotransformer

Where a 220 VAC main line voltage is available, it is possible to connect the RBF rack directly to the main line. However to limit the in-rush current, it is MANDATORY to use a three phase line inductor.

The auxiliary voltage must ALWAYS be connected between two of the 220 VAC line phase (see diagram below).



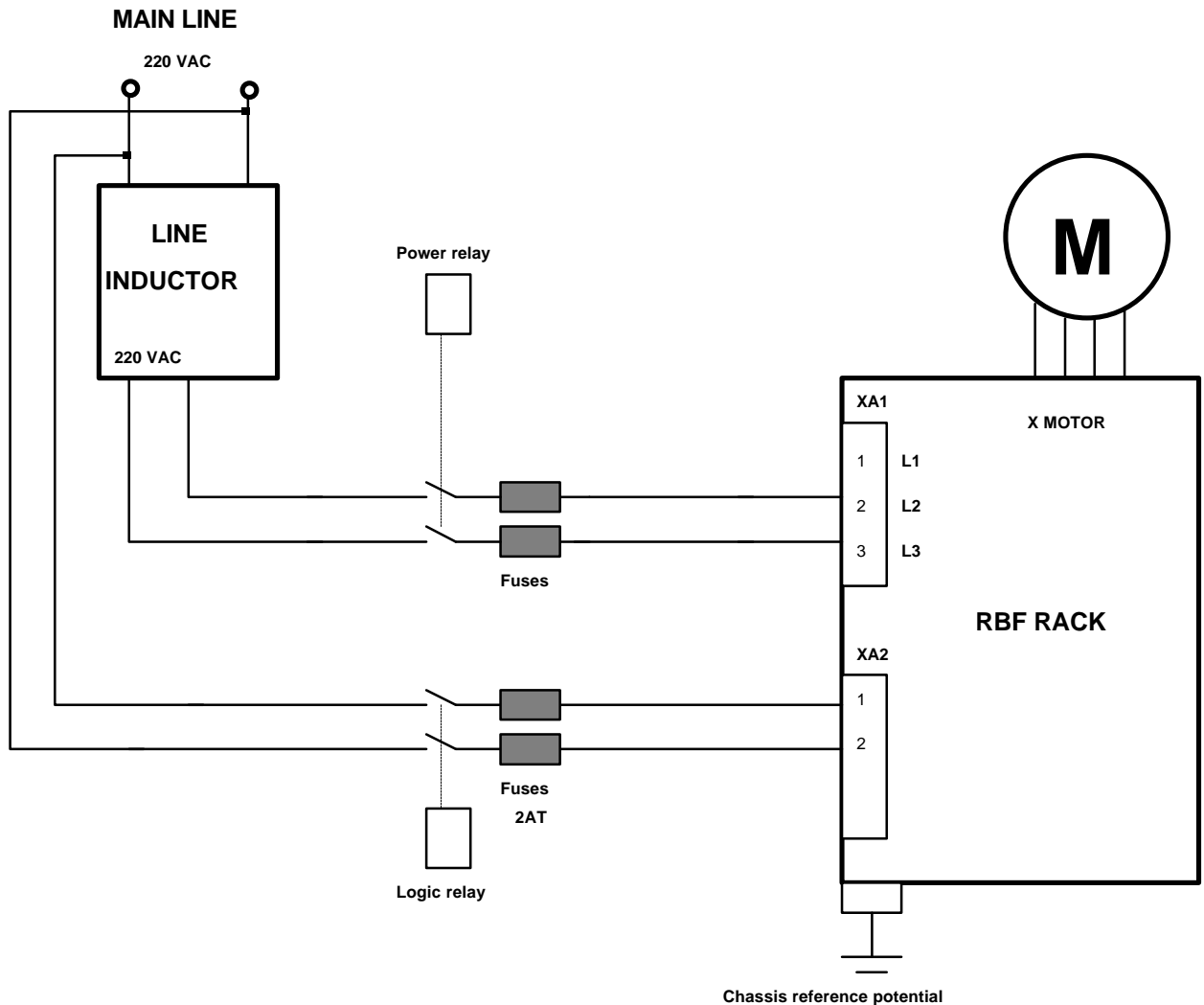
- All supply line voltage must **ABSOLUTELY** be connected through a relay contactor to cut all lines at the same time (main power and auxiliary supply).
- The “logic relay” **MUST BE** activated before the “power relay” (minimum 2sec.)
- The grounding of the RBF rack is MANDATORY in order to avoid any physical damages in case of insulation failure.
- Infranor recommend the use of a differential circuit breaker to control any insulation failure to earth ground.
- See chapter 4.4.0 for three phase line reactor specifications and dimensions.

3.6.0 Single phase connection without autotransformer

Single phase connection directly into the 220 VAC main line is also possible where the maximum continuous current do not exceed 20 ADC (14 Arms).

It is MANDATORY to add a single phase line inductor as for the three phase connection.

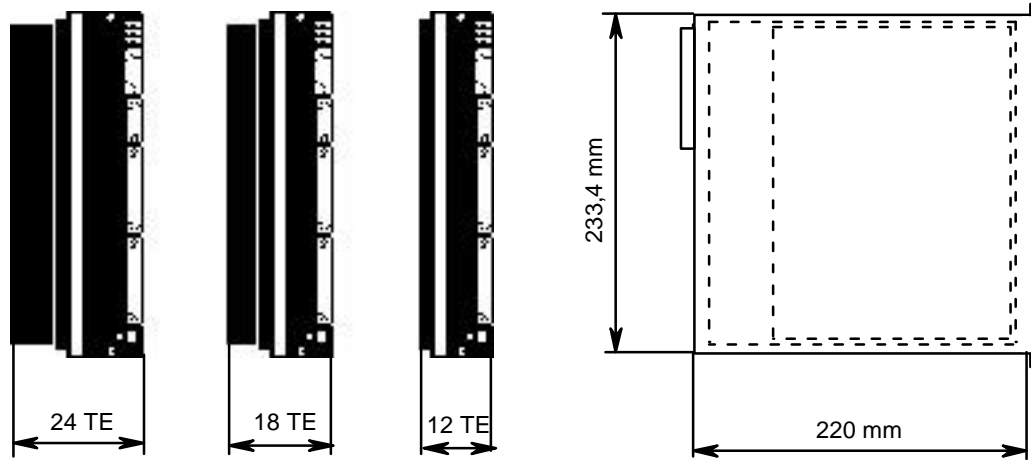
The auxiliary voltage must ALWAYS be connected between two of the 220 VAC line phase (see diagram below).



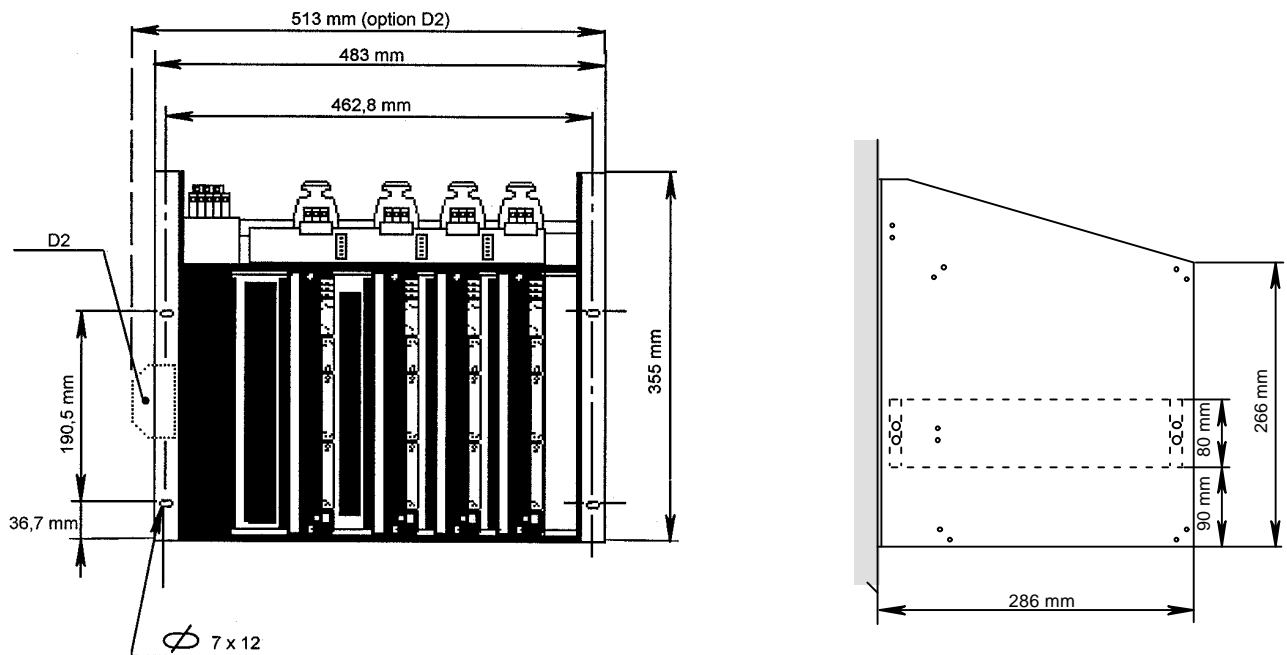
- All supply line voltage must ABSOLUTELY be connected through a relay contactor to cut all lines at the same time (main power and auxiliary supply).
- The “logic relay” **MUST BE** activated before the “power relay” (minimum 2sec.)
- The grounding of the RBF rack is MANDATORY in order to avoid any physical damages in case of insulation failure.
- Infranor recommend the use of a differential circuit breaker to control any insulation failure to earth ground.
- See chapter 4.4.0 for single phase line reactor specifications and dimensions.

4.0.0 DIMENSIONS

4.1.0 Amplifier dimensions

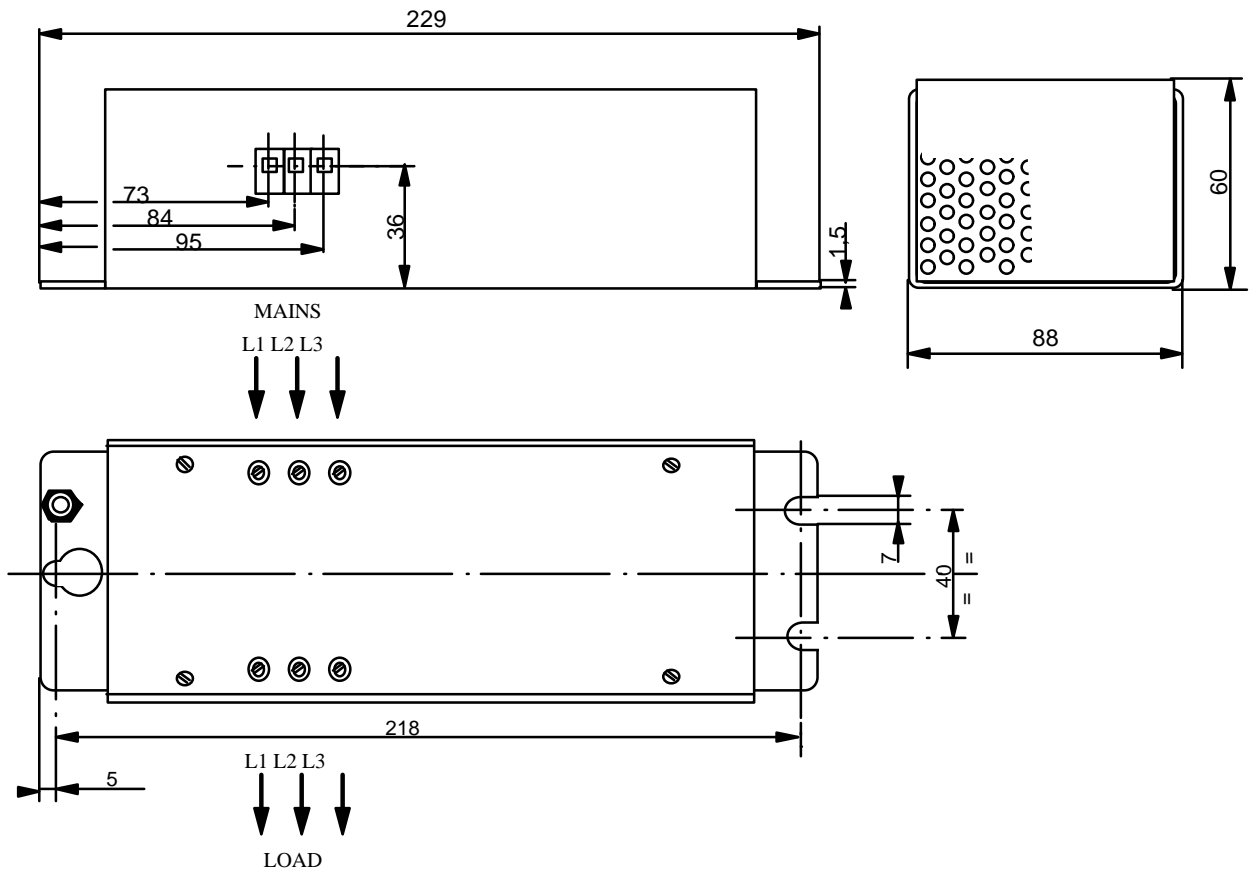


4.2.0 RBF rack dimensions



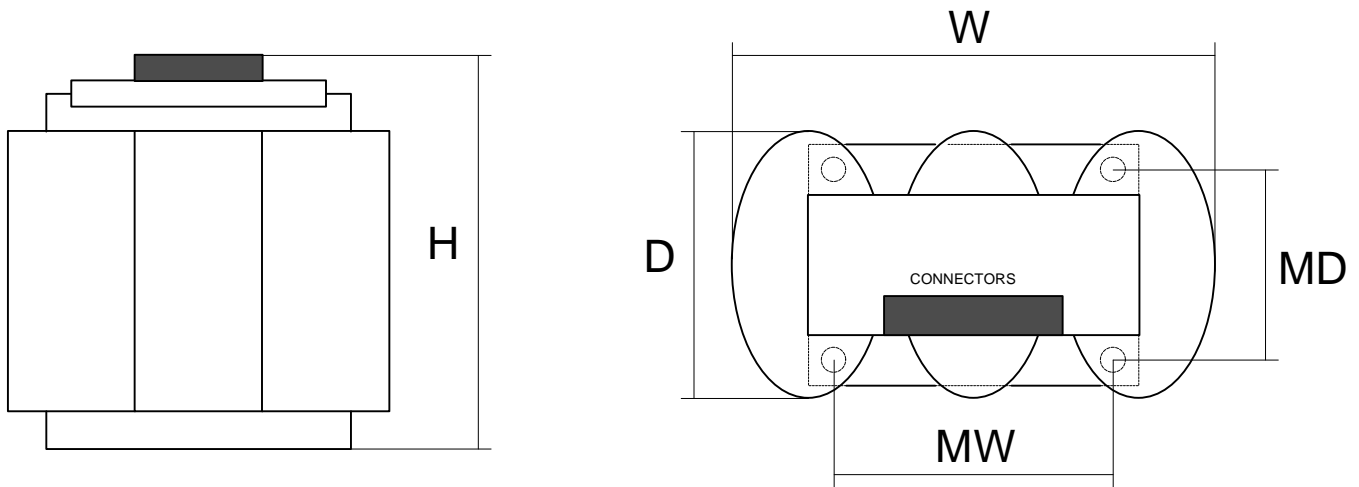
		# of	2	3	4	5	6
Axis Modules SMTB							
DIMENSION "A"	inches		7.2	9.6	12.0	14.4	16.8
	millimeters		182.9	243.8	304.8	365.7	426.7
DIMENSION "B"	inches		8.71	11.11	13.51	15.91	18.31
	millimeters		221.3	282.2	343.2	404.1	465.1
DIMENSION "C"	inches		9.41	11.81	14.21	16.61	19.0
	millimeters		239.2	300.1	361.1	422.1	483.0
			36TE	48TE	60TE	72TE	84TE

4.3.0 Line filter dimensions BF35 - BF70



4.4.0 Line reactance dimensions

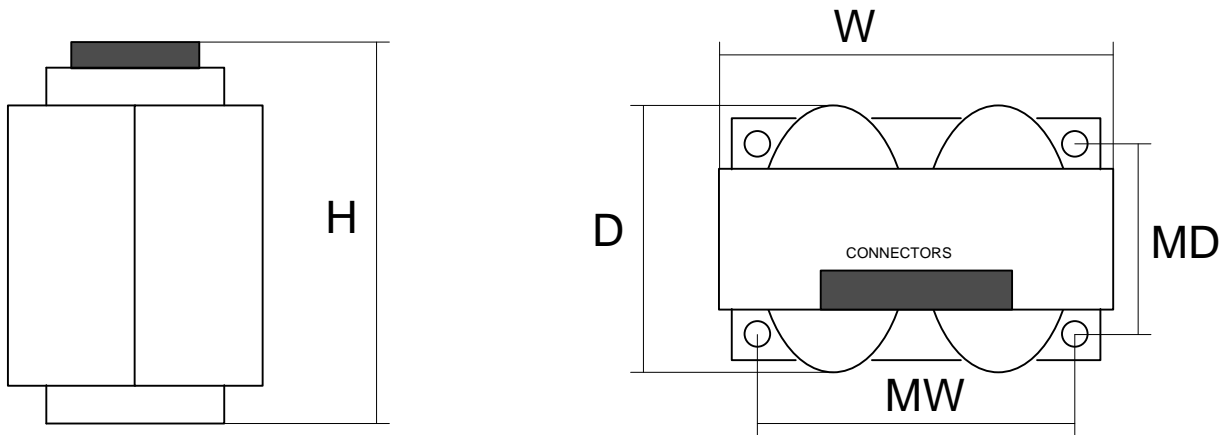
4.4.1 Three phase line reactance (60Hz)



MODEL	RACK	CURRENT		H	W	D	MW	DW	LBS.
I3-2435	RBF-35	35A		7.5	7.25	5.0	4.82	3.13	18
I3-2480	RBF-70	70A		9	9	6	6	4	34

Dimensions are in inches

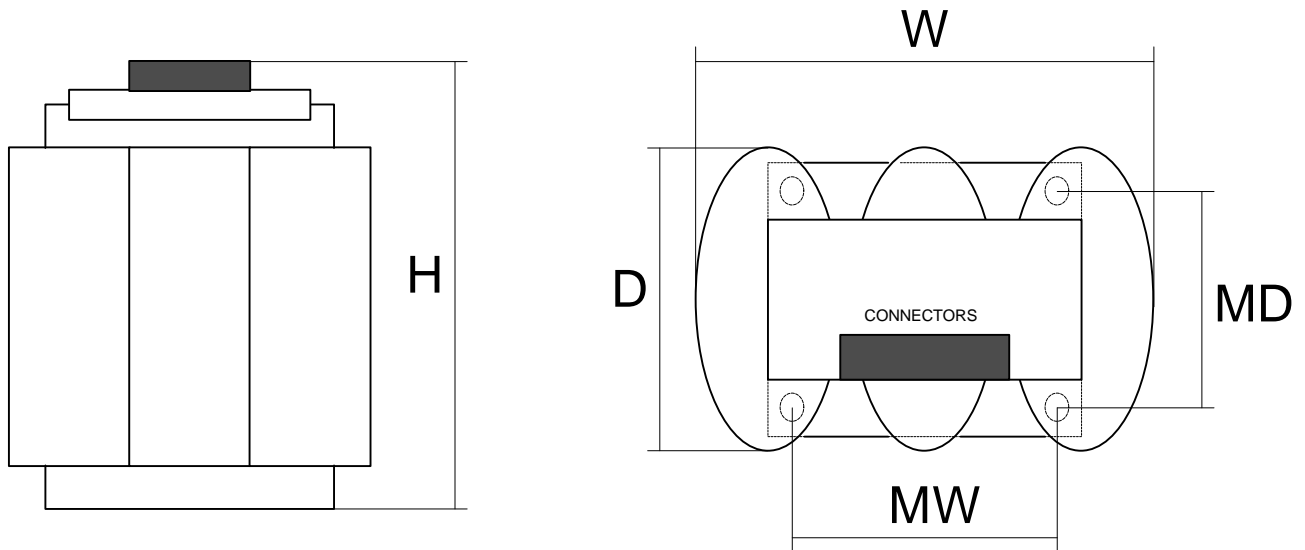
4.4.2 Single phase line reactance (60Hz)



MODEL	RACK	CURRENT		H	W	D	MW	DW	LBS.
I1-2420	SMTBM-20A RBF-35*	20A		3.50	4.13	3.50	3.44	2.63	8

* Total RMS current lower than 14Arms
Dimensions are in inches

4.5.0 Autotransformer dimensions

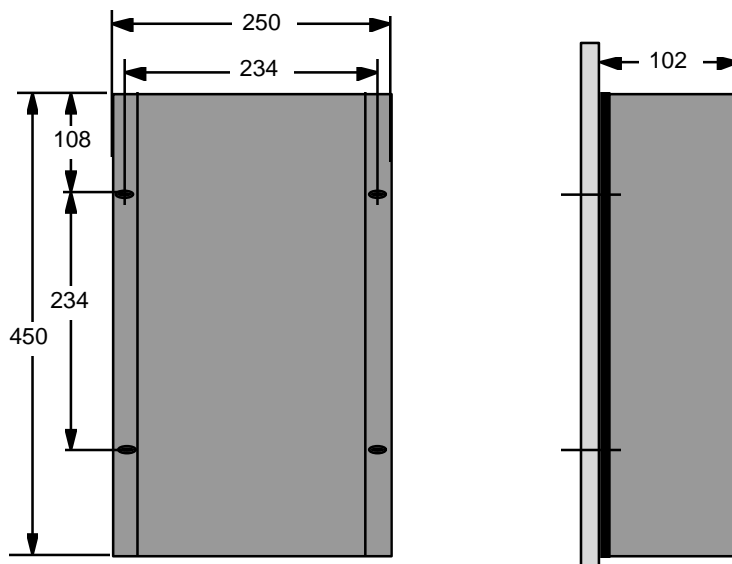


- Three phase autotransformer 60Hz
- Temperature Class H, 155 Degree C
- Insulation Class N, 200 Degree C
- Open frame

MODEL	PRIMARY VOLTAGE	SECONDARY VOLTAGE	KVA	H	W	D	MW	DW
ATR3-2000-600-220	480/600	220	2	9.75	8.75	5.00	4.00	4.00
ATR3-3000-600-220	480/600	220	3	9.75	8.75	5.75	4.00	4.25
ATR3-4000-600-220	480/600	220	4	9.75	11.00	5.50	9.00	3.94
ATR3-5000-600-220	480/600	220	5	9.75	11.00	6.50	9.00	4.87
ATR3-7000-600-220	480/600	220	7	9.75	11.00	7.00	9.00	5.37

Dimensions are in inches

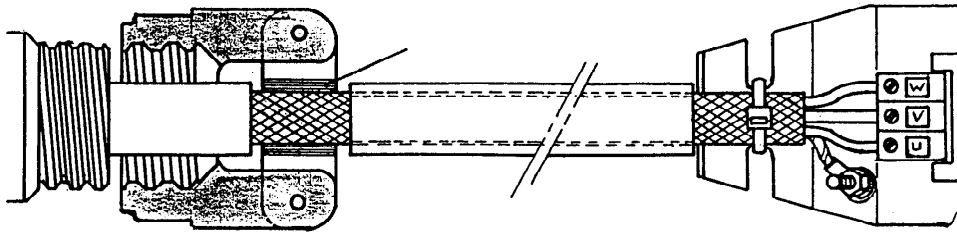
4.6.0 D1 shunt regulator dimensions (in mm)



4.7.0 Shielding recommendations

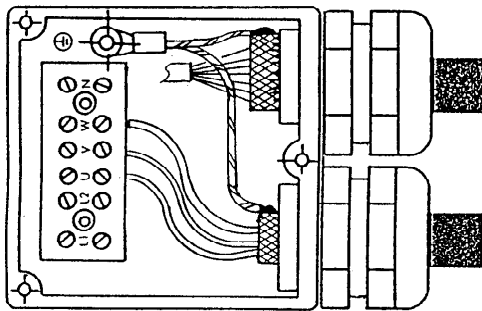
There must never be a shield interruption on the whole cable length.

Self-sticking copper ribbon if necessary for increasing the shield diameter to get properly tightened under the clamp



**Connector on MAVILOR
motor for resolver and motor**

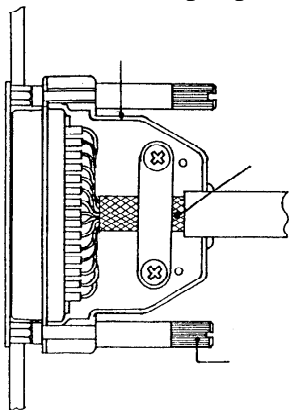
RBF RACK



The cable can be soldered on the shield because the connector box is metallic
This solution does not correspond exactly to the IEC requirements, but it is acceptable

Connector box on the MAVILOR motor

Metallic or metal plated plastic
Sub-D pin package



360 degrees shield ensured by
the tightening clamp

The fastening screw must be tightened
in order to ensure the shield continuity
on the amplifier housing

Sub-D connector

Note: When the 360 degrees shield is made by means of a clamp, it is not necessary to connect a wire to the appropriate pin on the Sub-D connector.