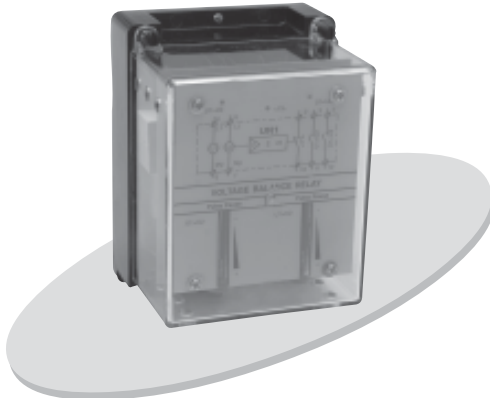
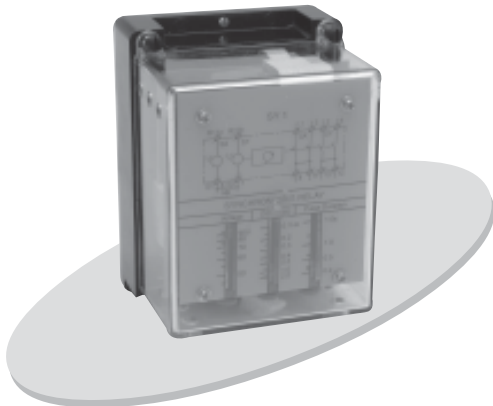
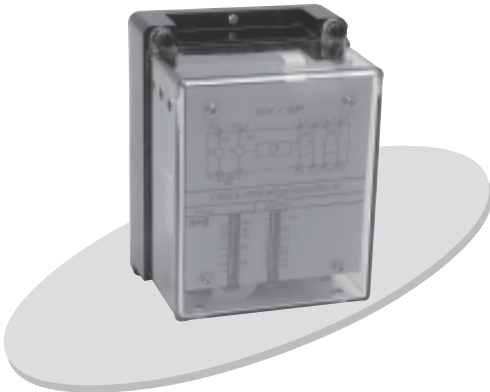
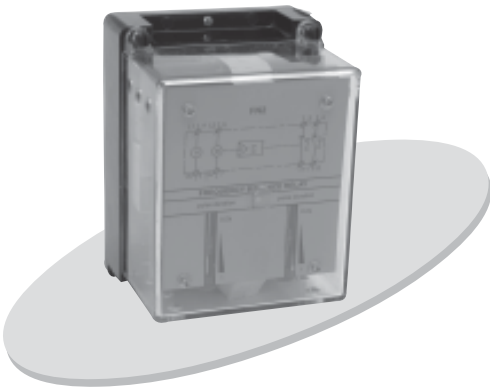


Functional Range

Synchronising Relay : UN1, FN2, SY1, SY/SP



C&S Protection & Control Ltd.

Contents

	Page No.
1. Introduction	3
2. Voltage Balance Relay Type UN1	3-4
3. Frequency Balance Relay Type FN2	5
4. Synchronising Relay Type SY1	6-8
5. Synchronising Check Relay Type SY/SP	9-11

1. Introduction

Each time a Generator is connected to another power system it has got to be electrically connected, the method of this connection is called Synchronisation.

Generator can be synchronised only when the conditions as below are satisfied :

- Voltage of the two sources to be equal or within tolerance of 1%,
- Frequency of the two sources to be equal or within tolerance of 0.15 Hz &
- Phase angle difference to be zero or maximum difference to 7°.

These conditions can be satisfied Automatically by using **UN1** -Voltage Balance Relay, **FN2** -Frequency Balance Relay, **SY1** -Synchronisation Relay and for manual synchronisation the **SY/SP** -Check Synchronisation Relay.

Further more, a complete automatic power station should also have Load Balancing Relay -**WLA2** and Frequency Regulator Relays -**SFG3**.

Semi-automatic synchronization by synchronizing unit **SY1** means :

Manual speed up or slow down the genset to equalize the frequency / manual setting of alternator voltage / monitoring of frequency difference, voltage difference and phase angle by paralleling unit **SY1** / impulse to close alternator **CB** by unit **SY1**.

Fully-automatic balance **FN2** senses the frequency difference between bus bars and genset. It provides correction pulses to the electrical governor of the driving motor to speed up or slow the generator as required for synchronization.

Voltage balancer **UN1** senses the voltage difference between bus bars and alternator. It provides correction pulses to the motorized setting potentiometer to adjust alternator voltage as required for synchronization.

Paralleling unit **SY1** monitors frequency difference voltage difference and phase angle and provides closing impulses for the alternator circuit breaker. With the load balancing unit **WLA2** automatic load balance can subsequently be carried out.

UN1 - Voltage Balance Relay

Application

This unit is used for automatic voltage balancing between three-phase alternators, preferably paralleling alternators with the mains supply and alternators with out paralleled excitation systems.

The motorized potentiometer for the voltage setting receives impulses to adjust the required voltage.

Function

The unit **UN1** consists of two measuring circuits, one is the main or reference supply and the other is connected to the system which is to be balanced. It is useful to have an additional selector switch "Manual-Automatic" in the synchronisation scheme.

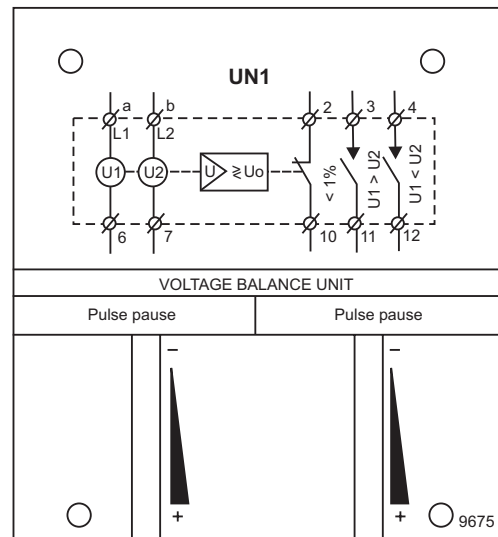
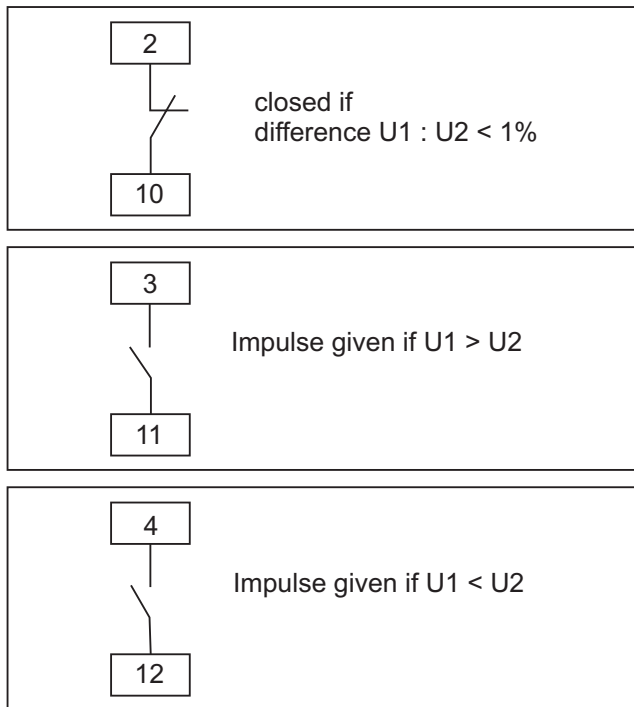
The Unit compares the two supplied voltage and gives outgoing impulses to the motorized potentiometer. In case of high voltage difference between two systems the intervals between the impulses are shorter and in case of lower difference between the voltages the various motorized potentiometers, the impulses are adjustable using two built-in potentiometers.

A built-in voltage measuring circuit closes a contact on terminal 2/10 when the voltage difference between the two supplies is smaller than 1%. This contact can be used in series with the impulses contact of the paralleling unit **SY1**. That means the closing impulse for the alternator circuit breaker is given only when the voltage difference is lower than 1%.

It is recommended that the supply voltages are switched off after paralleling.

Contact Positions

Front Panel



Technical Data

UN1- Voltage Balancing Unit

Connection voltage	:	230V, 110V
Nominal frequency	:	50Hz, 60Hz
Pulse duration	:	0.3s
Pulse interval	:	0.3 ... 1s
Power consumption	:	5VA per system
Automatic tracking at	:	deviation > 1%
Duty	:	100% (continuous)
Adjustability	:	Self-locking spindle-potentiometer for both adjustments, inside cover.
Contact equipment	:	1 NO for voltage $U_1 > U_2$, 1 NO for voltage $U_1 < U_2$, 1 NC for voltage $U_1 : U_2 < 1\%$
Contact rating	:	1250VA at 230V AC
Connection terminals	:	2.5 mm ²
Housing Dimensions	:	CSPC -standard case W x H x D : 105 x 142 x 91 mm
Outer case material	:	Track-resistant moulded base with transparent cover
Type of protection	:	Case IP 10, terminals IP 00
Weight	:	0.4kg
Maintenance	:	None
Service life	:	10 ⁵ operations
Mounting	:	Flush mounting

FN2 - Frequency Balance Relay

Application

This unit has been developed for automatic equalization of the frequency of generating sets. Output control impulses are given for speed governor motors, motorized potentiometers, steam control valves and the like.

Functions

The frequency control unit is supplied from one phase of each system (one phase busbar system and one phase alternator). A selector switch for "manual and automatic" selection is useful.

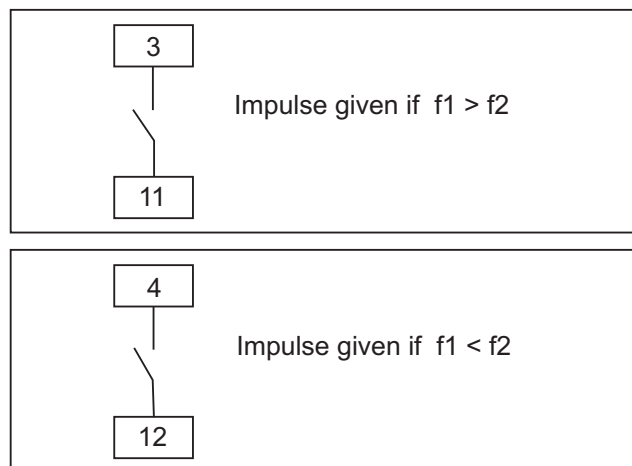
This unit compares the two frequencies and gives output impulses in the right direction (slower or faster) to the speed governor motor. The interval between the impulses is shorter when the difference in frequency is high and longer when the difference is low, in order to achieve fastest regulation. The length of the output impulses are adjustable on two potentiometers, to adapt this unit to different types of speed governor motors. It is recommended that the frequency control unit should be switched off when the generating set is already in parallel, to prevent interferences with the load balancing.

Technical Data

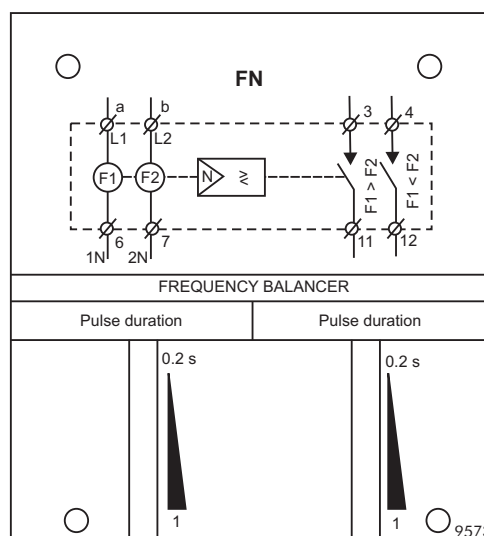
FN2- Frequency Balancing Relay

Type	:	FN2
Connection voltage	:	230V, 110V
Nominal frequency	:	50Hz, 60Hz
Impulse time	:	0.2...1s
Power consumption	:	3VA per system
Permissible voltage tolerance	:	+10/-15%
Duty	:	100%
Adjustability	:	Self-locking potentiometer with screw for fine adjustment
Contacts	:	1 NO for frequency $f_1 > f_2$, 1 NO for frequency $f_1 < f_2$
Contact rating	:	Max.1250VA at 230V AC
Connection terminals	:	Metric 4, wires max. 2.5 mm ²
Case	:	CSPC -standard case W x H x D : 105 x141 x 91 mm
Material	:	Track-resistant moulded base with transparent cover
Type of protection	:	Case IP 20, terminals IP 00
Weight	:	0.4kg
Maintenance	:	None
Service life	:	10 ⁶ operations
Mounting	:	Flush mounting

Contact Positions



Front Panel



SY1 - Synchronising Relay

Application

This unit is normally used for switching on parallel generating sets with either the mains supply or with other generating sets.

Suppositions for switching in parallel are :

coincidence of the phase

equal voltage

equal frequencies

Synchronizing unit SY1 is monitoring these values and gives an output impulse, when they are within their pre-set limits.

Function

The synchronizer unit SY1 is supplied from one phase of each system. The unit compares the two frequencies, the difference in voltage and measures the phase coincidence and gives lead impulse to close the alternator circuit breaker.

Note : The synchronizing unit SY1 is not suitable for paralleling of synchronous mains i.e. if same supply voltage is applied to terminals a-6 & to terminals b-7. The synchronisation impulse contact does not close.

For paralleling, the SY1 requires a beat of the systems to be synchronized. As this "beat" is not available from synchronous mains, the SY1 can not give the switch-on impulse, not even if the angular system difference should be "O". For paralleling of synchronous mains the CSPC synchronizing unit PSY2/N can be used.

For gensets with a higher capacity (>1000kV) and an increased rotating mass, we would recommend the use of our automatic synchronizing units PSY2 or PSY3. They combine all functions of the individual units, FN2, UN1 and SY1, and provide improved adjustment possibilities.

Possible adjustments, taking into account specific values are :

Adjustments

1. Max. permissible difference in frequency

The max. permissible frequency difference is dependent on the kind and size of the driving engine and the fly wheel of the generating set.

Following are a few examples :

0.1Hz When sets of medium and big size

0.2Hz When sets of small size, turbine sets and Diesel engine generating sets above 500 kW.

0.4-0.6Hz Diesel engine generating sets from 50-500 kW.

0.7-1.5Hz Diesel engine and combustion engine driven generating sets up to 60 kW, with the suppositions : no heavy fly wheel, compound alternators and quick switching circuit breakers.

The max. permissible 2. This is the decisive adjustment for the permissible switching time for the alternator circuit breaker, adjusted with potentiometers 1 and 3.

2. Permissible switching time and adjustment of impulse length

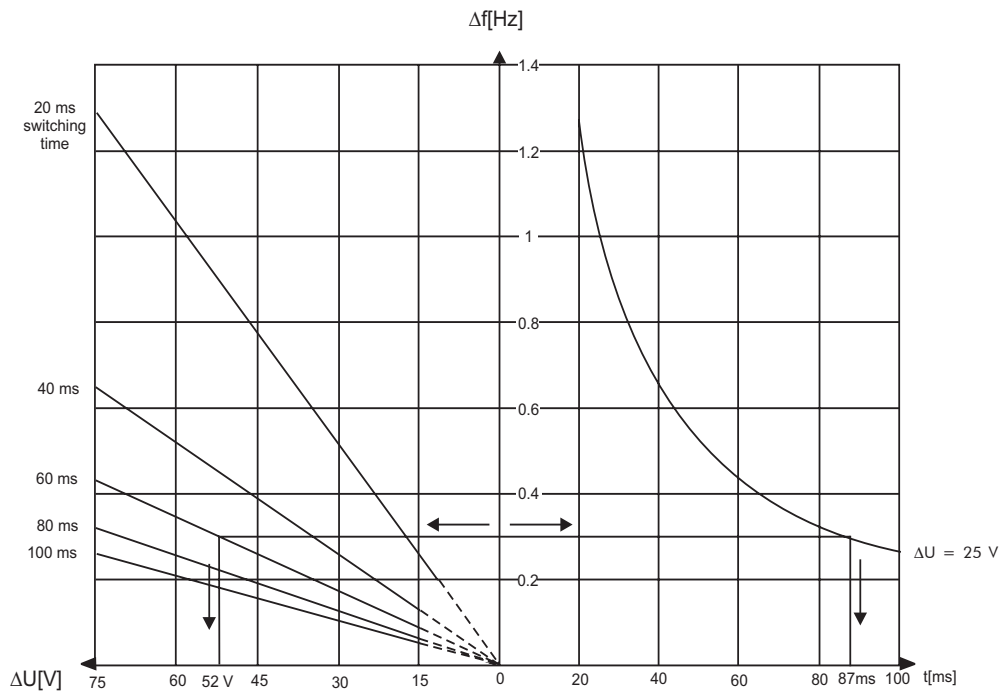
Only quick switching circuit breakers should be used, e.g. air contactors, magnet operated circuit breakers. Choose the max. permissible switching time of the circuit breaker in the right hand part of the diagram.

Example

Frequency difference 0.3 Hz-cuts the line for a switching time of 87 ms. Quick circuit breakers are more advantageous, slow ones not to be used.

For adjustment of potentiometer 3 do the following :

Switching time of the circuit breaker if used with switching time of an auxiliary relay add additional 100 ms. e.g. switching time of the circuit breaker 40ms makes 160 ms to be set at potentiometer 3.



Note : For HT system (using 110V) do not short terminals 6 & 7 as shown on the front plate.

3. Leading of the impulse

The main contacts of the circuit breaker should close exactly at the moment when the phase coincidence is given.

This is the reason why the output impulse is leaded. The necessary leading time is dependent on the max. permissible frequency difference (potentiometer 2 and the switching time of the alternator circuit breaker.

This unit measures the voltage difference of the two systems in order to give the exact lead time.

This permissible voltage difference should be set at potentiometer 1 in accordance to the left hand part of the diagram.

Example

With the above used values :

Frequency difference 0.3 Hz; circuit breaker 40 ms:

auxiliary relay 20 ms makes 60 ms starting at 0.3 Hz crossing the line for 60 ms one finds under this crossing the adjustment of 52V for the potentiometer-adjustment 52V.

For alternators with a voltage difference between idle and full load higher value up to 10V is necessary.

The dashed range of the straight line (difference voltage below 10V) is normally not reached, since the voltage of the alternators has a large harmonic content.

The values are related to a unit with a nominal voltages it is necessary to multiply the values by appropriate multiplication factor, which is indicated on the front panel.

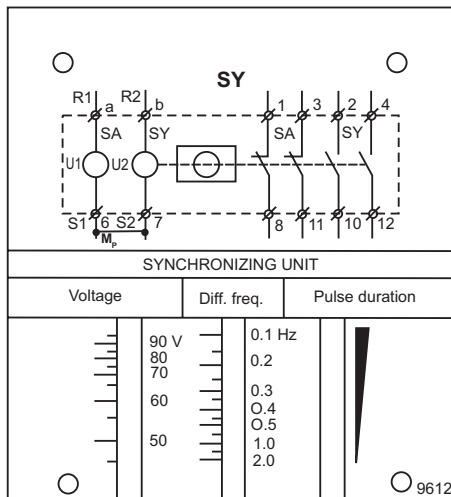
3.1 Dead Bus Contact

Synchronizer unit SY1 has one additional contact which is open when the bus bar system is under voltage and closed when there is no voltage at terminals a and 6. This contact can be used to switch in the alternator circuit breaker directly without synchronization in case of no voltage on the bus bar system.

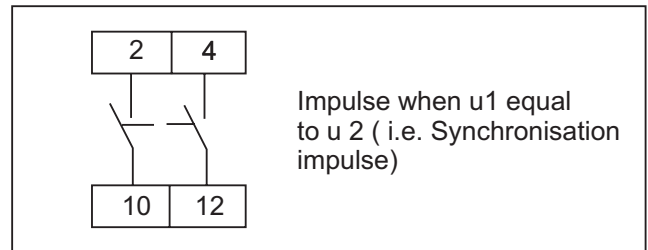
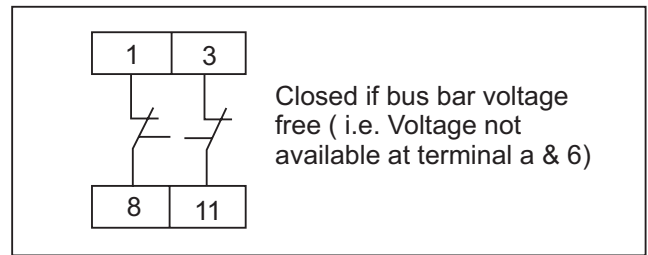
Additional information for marine applications

According to the Germanischer Lloyd it is not allowed to set the frequency difference higher than 1 Hz.

Front Panel



Contact Positions

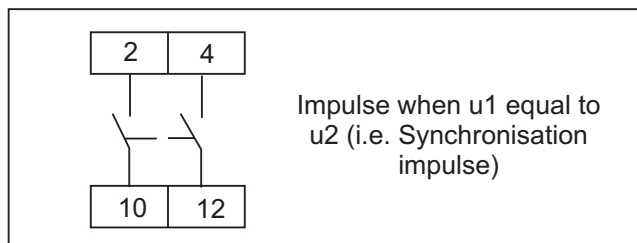
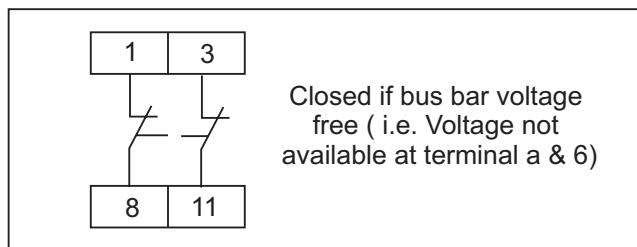


Technical Data

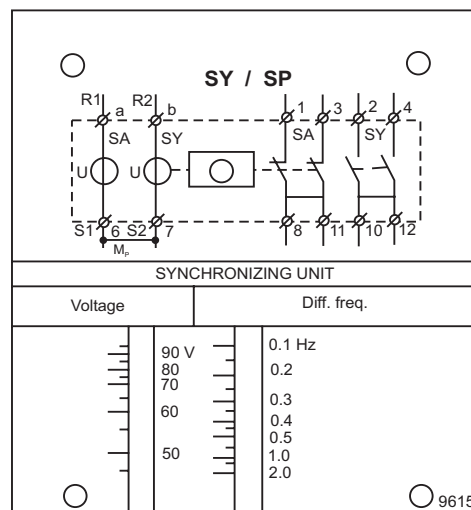
SY1- Paralleling Unit

Type	:	SY1
Connection voltage	:	230V, 110V
Nominal frequency	:	50Hz, 60Hz, 400Hz
Adjustable limit of Frequency difference	:	0.1...2Hz
Adjustable limit of Floating Voltage difference	:	45 ... 95V AC
Adjustable length of impulse	:	0.1 ... 0.5s
Power consumption	:	ca 3 VA
Permissible voltage tolerance	:	+10/-15%
Permissible switch-on time	:	100% ED
Adjustability	:	Self-blocking potentiometer with screw for fine adjustment
Contacts	:	2 NO-contact for switching in parallel; 2 NC-contact for bus bar voltage
Contacts capacity	:	Max. 1250VA at 230V AC
Case	:	CSPC-standard case H x B x T : 141 x 105 x 91 mm
Connection terminal	:	Matric 4, wires max. 2.5 mm ²
Type of protection	:	Case IP10, terminal IP00
Weight	:	0.4kg
Maintenance	:	None
Mounting	:	Flush mounting

Contact Positions



Front Panel



Technical Data

SY/SP- Synchronising Check Relay

Type	:	SY/SP
Connection voltage	:	230V, 110V
Nominal frequency	:	50Hz, 60Hz, 400Hz
Adjustable limit of		
Frequency difference	:	0.1...2Hz
Adjustable limit of		
Voltage difference	:	45 ... 95V AC
Consumption	:	ca 3 VA
Permissible voltage limit	:	+10/-15%
Permissible switch-on time	:	100% ED
Adjustability	:	Self-blocking potentiometer with screw for fine adjustment
Contacts	:	2 NO-contact for switching in parallel; 2 NC-contact for bus bar voltage
Contacts power	:	Max. 660VA at 230V AC
Type of protection	:	CSPC-standard case H x B x T : 141 x 105 x 91 mm
Connection terminals	:	Metric 4 max. wires 2.5 mm ²
Type of protection	:	Case IP 10, terminals IP00
Mounting	:	Flush mounting
Weight	:	0.4kg
Service life	:	10 ⁶ switching operations
Maintenance	:	None

8. Information Required with Order

When placing an order, please fill in the form on the or mention in your order the complete type key.

Voltage Balance Relay		UN1
Number	Supply Voltage	Nominal frequency
<input type="text"/>	UN1- <input type="text"/>	<input type="text"/>
	110 = 110V 230 = 230V	50 = 50/60Hz

Frequency Balance Relay		FN2
Number	Supply Voltage	Nominal frequency
<input type="text"/>	FN2- <input type="text"/>	<input type="text"/>
	110 = 110V 230 = 230V	50 = 50/60Hz

Synchronizing Relay		SY1
Number	Supply Voltage	Nominal frequency
<input type="text"/>	SY1- <input type="text"/>	<input type="text"/>
	110 = 110V 230 = 230V	50 = 50/60Hz 400 = 400Hz

Synchronizing Check Relay		SY/SP
Number	Supply Voltage	Nominal frequency
<input type="text"/>	SY/SP- <input type="text"/>	<input type="text"/>
	110 = 110V 230 = 230V	50 = 50/60Hz 400 = 400Hz

*Data subject to change without notice.

For further information, please contact :



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