Order Number | | Serial Number | |

PRODUCT / TEST MANUAL

2SY110K1

SYNCHRONISM CHECK RELAY

Issue Level	Date	Summary of changes
A	31/10/1996	Initial issue.

Due to RMS continuous product improvement policy this information is subject to change without notice.

Document updated	Checked	Registered	.pdf file created	.pdf uploaded to web site

1. BROAD DESCRIPTION

The 2SY110K1 is a synchronism check relay which gives a continuous output contact closure when the two input voltages have remained within preset phase angle limits for a preset time and the voltage magnitudes are both above a minimum level. Phase angle is not considered if one or both voltages is below this level. Resetting occurs if any of the voltage conditions ceases to be true. A starting relay is provided to connect AC sensing and Dc auxiliary supplies to the unit and enable the unit to be de-energised by closure of the CB.

2. SPECIFICATION

DC Auxiliary Supply Voltage	D125 $\pm$20%
DC Auxiliary Supply Burden	<10W @ 125V
AC Sensing Voltage (Bus & Line Inputs)	A110 50Hz
AC Sensing Voltage Burden	<1.5VA @ 110V 50Hz
Ambient Temperature Range	-5^{o}C to 55 ^{o}C
Dead Bus & Dead Line Select Threshold (Switches provided to inhibit if required)	A16.5 $\pm$1.5V
Phase Measuring Circuitry	20 - 100^{o} $\pm$5^{o}
"Out of Phase" Response Time	100ms approx.
"In Phase" Response Time	1 - 10 Sec. $\pm$0.5 Sec
Output Contacts	3 Changeover
Output Relay Contact Ratings	

Make and Carry Continuously
3000 VA AC resistive with maximums of 660 Volt and 12 Amp
3000 VA DC resistive with maximums of 660 Volt and 12 Amp

Make and Carry of 0.5 Second
7500 VA AC resistive with maximums of 660 Volt and 30 Amp
7500 VA DC resistive with maximums of 660 Volt and 30 amp

AC Break Capacity
3000 VA AC resistive with maximums of 660 Volt and 12 Amp

2. SPECIFICATION (Cont)

DC Break Capacity (Amps)

Voltage			**24V**	**48V**	**125 V**	**250V**
Resistive rating		**a** **b**	12 12	1.5 12	0.5 10	0.25 5
L/R=40 mS	Maximum break	**a** **b**	12 30	1 15	0.4 5.5	0.2 3.5
	1K operations (N3 Rating)	**b**	12	12	5	2.5

a = Without magnetic blowouts b = With magnetic blowouts
* As tested by Powernet Yarraville laboratories in Victoria.

3. TEST EQUIPMENT REQUIRED

125V Auxiliary Supply
2 x AC 0-300V Amplifiers
50Hz Oscillator
50Hz Adjustable Phase Shifter
Digital Voltmeter
Oscilloscope Dual Trace
Frequency & Period Counter
Pickup and Dropout Time Measuring Apparatus
Decade Boxes
High Voltage Test Equipment

4. ASSOCIATED DRAWINGS

171-110-101	2SY110K1 Wiring Diagram
660-110-201	Circuit Diagram PCB Dual Voltage Sensing & Timer
660-116-201	Circuit Diagram PCB Phase Angle Measuring

5. HIGH VOLTAGE TESTING

a) Apply 2KV RMS between all terminals tied together and frame for 1 minute.

b) Apply 5 5KV 1/50 impulses between all terminals tied together and frame.

c) Apply one 5KV 1/50 impulse of each polarity between auxiliary supply positive and negative terminals (1 and 2 respectively).

6. CALIBRATION & TEST PROCEDURE

6.1 General

The phase angle measuring circuitry in this unit is fed from a low voltage (10V nominal) winding on each of the two input interfacing transformers. The two input signals are fed into separate squaring amplifiers and the output square waves mixed to generate a rectangular wave with the negative going pulse length proportional to the incoming phase angle difference. This waveform controls the up-integration time of a linear integrator and when the negative-going pulse has passed, the integrator resets to zero, ready for the next input pulse. The resultant integrator output waveform is a triangular waveform with a linear rising edge and exponentially decaying trialing edge. The amplitude is proportional to the phase difference between AC input signals and a front panel variable threshold level detector is used to sense if the height of this waveform exceeds a preset value (representing the phase angle setting). The resultant output pulses edge-clock a 3 stage binary counter to give a continuous “out of phase” signal if this condition exists. A second binary counter (4 stage) is clocked by the integrator control waveform and is reset by any “out of phase” pulses. If this counter times out it resets the 3-stage counter thus signalling the in-phase condition.

The voltage sensing circuitry used on 660/110 PCB contains two identical sensing circuits. The incoming AC waveform (10V nominal) is “perfect” rectified, smoothed and fed into a comparator. If the level exceeds a predetermined value, a logic high (and also its complement) is fed to some combinational logic on the phase angle measuring board.

The timer on the voltage measuring board is initiated from the abovementioned logic circuitry and contains a front panel variable oscillator and ripple counter to give a continuous output “high” when the count reaches 8192.

6.2 Calibration of 660/110-1 Voltage Sensing Circuitry

a) Component reference numbers refer to Circuit Diagram 660-110-201.

b) Connect AC phase and amplitude variable supplies to 2SY110 (refer to 171-110-101 for connection details).

c) Connect decade box to R26 avlugs.

d) Apply 125V DC auxiliary supply to unit and check that start relay RL1/4 picks up.

d) Adjust decade box until PCB pin 13 (motherboard avlug W) goes low as the line input voltage is reduced below 16.5V.

f) Replace decade box with fixed resistor and repeat (e).

Minimum	Maximum	Nominal	Actual	Unit
15	18	16.5		V

g) Connect decade box to R24 avlugs.

h) Adjust decade box until PCB pin 23 (motherboard avlug Y) goes low as the bus input voltage is reduced below 16.5V.

Minimum	Maximum	Nominal	Actual	Unit
15	18	16.5		V

6.3 Calibration of 660/110-1 Timer

a) Component reference numbers refer to Circuit Diagram 660-110-201.

b) Cut links A, B, C to give delay operate mode and to set the ripple counter divide ratio to 8192.

c) Load Ca position with .018uF if not already loaded.

e) Adjust trimpot R22 to give a maximum to minimum period ratio (measured at avlug B) of exactly 10 to 1 for dial scale and settings.

e) Pad C4a as necessary to give the following scale end periods:

Minimum	Maximum	Nominal
0.242	0.247	0.244
2.417	2.465	2.441

f) Check the following scale settings for accuracy. The timer may be initiated by temporarily unplugging 660/116-1 and joining avlugs R and J on the motherboard.

Minimum	Maximum	Nominal	Actual	Unit
0.7	1.3	1		s
3.7	4.3	4		s
6.7	7.3	7		s
9.7	10.3	10		s

6.4 Calibration of 660/116-1 Phase Angle Measuring Circuitry

NOTE: The zenered 10V and 20V supplies for this board are derived from the 660/110-1 board. If the 660/110-1 board is not plugged in there will be no supply to the 660/116-1 PCB.

a) Component reference numbers refer to Circuit Diagram 660-116-201.

b) Apply 110V 50Hz to bus and line inputs. Set phase difference to 0^o using either a dual trace oscilloscope or phase meter.

c) Check that IC1 pin 8 is high. Note that if a small phase difference exists between inputs a negative-going pulse of width equal to the phase difference will appear at pin 8. If one of the transformer secondaries is incorrectly phased, IC1 pin 8 waveform will be a square waveform for the “in phase” condition.

d) Set trimpot R22 to the middle of its range and dial pot R21 to maximum setting (100^o).

d) Set incoming phase angle to 100^o and adjust trimpot R15 until PCB pin 6 just goes high (i.e. the in phase condition).

f) Set incoming phase angle and dial pot setting to 20^o.

g) Adjust R22 until PCB pin 6 just goes high.

h) Set incoming phase angle and dial pot setting to 100^o.

i) Adjust R15 until PCB pin 6 just goes high.

6.4 Calibration of 660/116-1 Phase Angle Measuring Circuitry (Cont)

j) Repeat steps f), g), h), i) until dial-pot scale is calibrated to the following accuracy:

Minimum	Maximum	Nominal	actual	Unit
17	23	20		deg

37	43	40		deg
57	63	60		deg
77	83	80		deg
97	103	100		deg

7. GENERAL & FUNCTIONAL

a) Check for correct operation of the timer initiate logic by observing that PCB pin 2 (motherboard avlug V1) goes low in the following cases:

b) Bus voltage greater than 16.5V and line voltage greater than 16.5V and inputs “in phase”.

Actual ☐

b) Bus voltage less than 16.5V and Dead Bus switch “in”. Line voltage and phase measuring circuitry output are not relevant.

Actual ☐

c) Line voltage less than 16.5V and Dead Line switch “in”. Bus voltage and phase measuring circuitry output are not relevant.

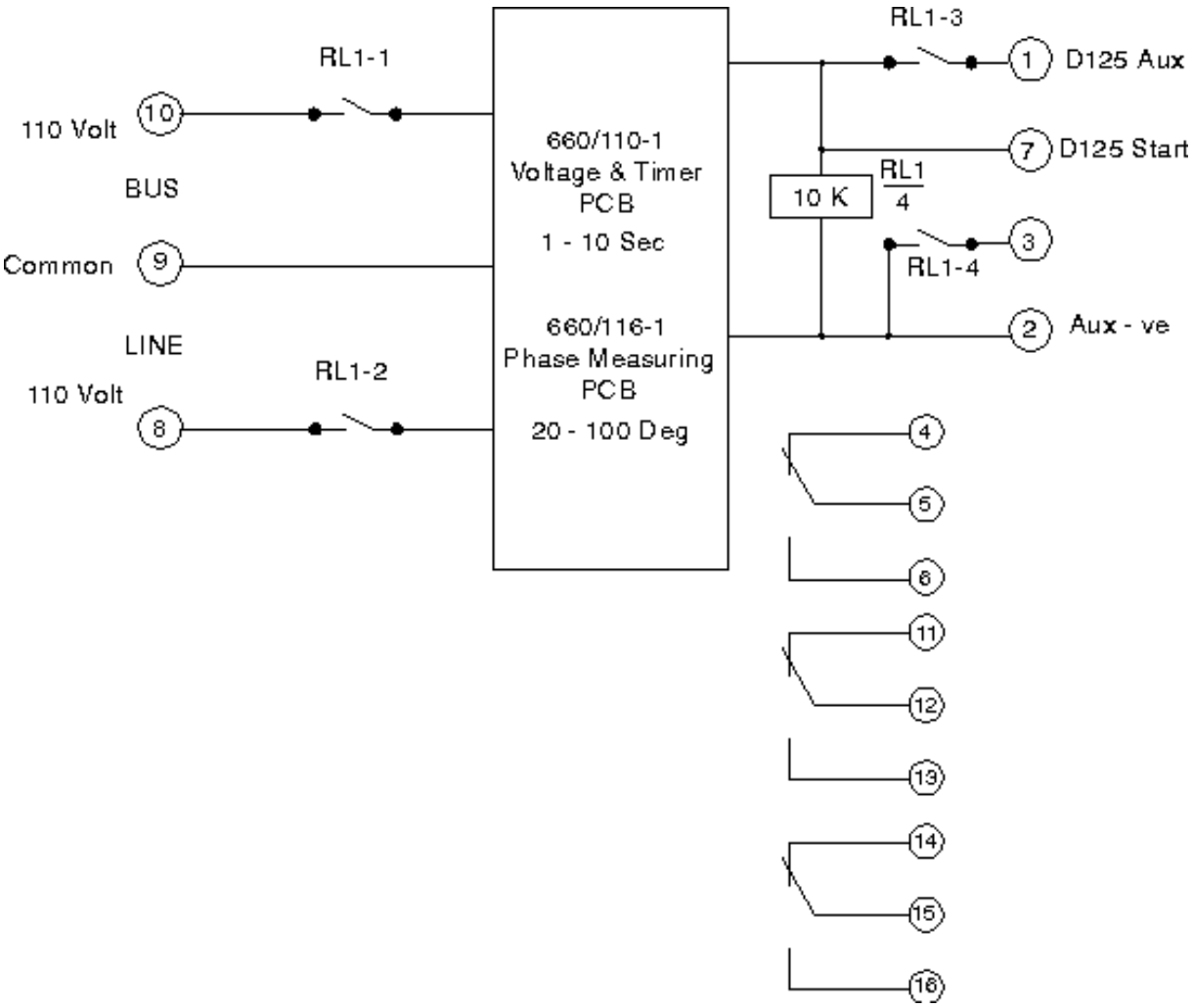
Actual ☐

d) Check that the relay is electrically sound and mechanically robust as per Standard Inspection and Test Schedule 903-000-026.

PASS ☐

TESTED BY: _____ DATE: _____

8. CONNECTION DIAGRAM


RL1-1
RL1-3
110 Volt
10
BUS
Common
9
LINE
110 Volt
8
RL1-2
660/110-1
Voltage & Timer
PCB
1 - 10 Sec
660/116-1
Phase Measuring
PCB
20 - 100 Deg
10 K
RL1
4
RL1-4
1
D125 Aux
7
D125 Start
3
2
Aux - ve
4
5
6
11
12
13
14
15
16