Order Number | | Serial Number | |

PRODUCT/TEST MANUAL

2SY110K7

SYNCHRONOUS CHECK RELAY

Issue Level	Date	Summary of changes
B	25/06/1996	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 2SY110K7 is a vertically mounted synchronism check relay which gives a continuous output contact closure when the two input voltages have remained with preset phase angle limits for a preset time and the voltage magnitudes are both above a minimum level of 80% of nominal. Phase angle is not considered for input voltages below the 15% level, but the unit will give an output contact closure if the Dead Line and/or Dead Bus select relays are operated and the relevant input is below this threshold. 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. SPECIFICATIONS

DC Auxiliary Supply Voltage	D125 ±20%
DC Auxiliary Supply Burden	<10W @ 125V
AC Sensing Voltage (Bus & Line Inputs)	A110 50Hz/63.5 50Hz
AC Sensing Voltage Burden	<1.5VA @ 110V 50Hz
Ambient Temperature Range	-5°C to 55°C
Undervoltage Lockout Threshold	88V ±1.5V
Dead Bus & Dead Line Select Threshold	A16.5 ± 1.5V
Phase Measuring Circuitry	10 - 50° ± 2.5°
"Out of Phase" Response Time	100ms approx.
"In Phase" Response Time	180ms approx.
Timer	1 - 10 sec ± 0.5 sec.
Output Contacts	2 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

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

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

171-110-107	2SY110K7 Wiring Diagram
660-116-205	Circuit Diagram PCB Phase Angle Measuring
660-116-305	Loading Diagram PCB Phase Angle Measuring
660-128-201	Circuit Diagram PCB Quad Voltage Sensing and Timer
660-128-301	Loading Diagram PCB Quad Voltage Sensing & Timer

5. HIGH VOLTAGE TESTING

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

b) Apply 3 5KV 1/50 impulses of each polarity between all terminals tied together and frame.

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 trailing 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 the 660/128-1 PCB contains two identical “perfect” rectifier and smoothing circuits each fed from a 10V transformer secondary winding. The DC outputs are each fed into two separate comparators to give a logic level corresponding to:

V bus > 88V, V line > 88V, V bus < 16.5V, V line < 16.5V.

These signals are fed via combinational logic on the 660/128-1 PCB back to the timer initiate input on 660/116-5.

6.1 General (Cont)

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 660/128-1 Voltage Sensing Circuitry

a) Component reference numbers refer to Circuit Diagram 660-128-201.

b) Cut links A, B, C on the MC14541 to set it to delay pick-up 1-10 sec operation.

c) Apply 125V auxiliary supply between enclosure terminals 3(+) and 2(-).

d) Apply 125V DC to Dead Line and Dead Bus Select relays (terminals 11-12 13-14 respectively).

e) Apply AC amplitude and phase variable supplies to unit as per Wiring Diagram 171-110-107.

f) Set Bus input to 88V and decrease trimpot R25 ("B80") until PCB pin 23 just goes high at this input voltage. i.e. PCB Pin 23 high for V bus > 88V.

Minimum	Maximum	Nominal	Actual	Unit
86	90	88		Volts

g) Set Bus input to 16.5V and increase trimpot R27 (B"15") until PCB pin 22 just goes high at this input voltage. i.e. PCB pin 22 high for V bus < 16.5V.

Minimum	Maximum	Nominal	Actual	Unit
15	18	16.5		Volts

h) Set Line input to 88V and decrease trimpot R29 (L"80") until PCB pin 13 just goes high at this input voltage. i.e. PCB pin 13 high for V line > 88V.

Minimum	Maximum	Nominal	Actual	Unit
86	90	88		Volts

i) Set Line input to 16.5V and increase trimpot R31 ("L15") until PCB pin 12 just goes high at this input voltage. i.e. PCB pin 12 high for V line < 16.5V.

Minimum	Maximum	Nominal	Actual	Unit
15	18	16.5		Volts

6.3 Calibration of 660/128-1 Timer

a) Initiate timer by taking PCB pin 8 to 0V. i.e. Connect to PCB Pin 17.)

b) Adjust trimpot R18 to give a maximum to minimum period ratio (measured at PCB pin 11) of exactly 10 to 1 for the dial scale end settings.

6.3 Calibration of 660/128-1 Timer (Cont)

c) Check the following scale settings for accuracy initiating the timer via PCB pin 8.

Pad C4b, C4c to give a waveform period of 2.441ms at PCB pin 11 at maximum time setting. Results:

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

6.4 Calibration of 660/116-5 Phase Angle Measuring Circuitry

a) Component reference numbers refer to Circuit Diagram 660-116-205.

b) Apply 110V 50Hz/63.5 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 is 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 phase 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 (50^o).

d) Set incoming phase angle to 50^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 10^o.

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

h) Set incoming phase angle and dial pot setting to 50^o.

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

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

Minimum	Maximum	Nominal	Actual	Unit
8	12	10		Degrees
18	22	20		Degrees
28	32	30		Degrees
38	42	40		Degrees
48	52	50		Degrees

j) Check for correct operation of the timer initiate logic by observing that PCB pin 8 (motherboard avlug L1) goes low in the following cases:

l) Bus voltage greater than 88V, Line voltage greater than 88V and inputs "in phase".

6.4 Calibration of 660/116-5 Phase Angle Measuring Circuitry (Cont)

m) Bus voltage greater than 88V, Line voltage less than 16.5V and Dead Line select relay energised.

n) Line voltage greater than 88V, Bus voltage less than 16.5V and Dead Bus select relay energised.

7. GENERAL & FUNCTIONAL

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

PASS ☐

TESTED BY :_____DATE :_____

8. CONNECTION DIAGRAM