Order Number | | Serial Number | |

PRODUCT TEST MANUAL

2SY110K8
SYNCHRONISM CHECK RELAY

Issue Level	Date	Summary of changes
A	10/02/1998	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. BRIEF DESCRIPTION

The 2SY110K8 is a 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 switches are operated and the relevant input is below this threshold. Resetting occurs if any of the voltage conditions ceases to be true. A timer enable relay permits the unit to be continuously energised, so when the timer is enabled the reclose pulse will occur, a set time after time out.

2. SPECIFICATION

DC Auxiliary Supply Voltage	D110 ±20%
DC Auxiliary Supply Burden	<10W @ 110V
AC Sensing Voltage (Bus & Line Inputs)	A110 & 63.5 50Hz
AC Sensing Voltage Burden	<1.5VA @ 110V 50Hz
Ambient Temperature Range	-5°C to 55°C
Undervoltage Lockout Threshold	80% ±2%
Dead Bus & Dead Line Select Threshold	15% ±2%
Phase Measuring Circuitry	10-50° ±2.5°
"Óut of Phase" Response Time	100ms approx.
"In Phase" Response Time	180ms approx.
Timer	1-10 sec. ± 0.5 sec.
Output Contacts	2 Changeover

Contact Ratings
Make & Carry Continuously
AC 2200 VA with maximum of 10 Amp and 440 Volt
DC 2200 VA with maximum of 10 Amp and 440 Volt

Make & Carry for 0.5 Seconds
AC 7500 VA with maximum of 30 Amp and 440 Volt
DC 7500 VA with maximum of 30 Amp and 440 Volt

AC Break Capacity
AC 2200 VA with maximum of 10 Amp and 440 Volt

DC Break Capacity (Amps)

Voltage		24	48	125	250
Resistive Rating		10	1.5	0.5	0.3
L/R = 40mS (N3 Rating)	Max Break	10	1	0.4	0.2

3. TEST EQUIPMENT REQUIRED

2 x AC 0-300 Amplifiers

50 Hz Oscillator
50 Hz Adjustable Phase Shifter
Digital Voltmeter
Oscilloscope, Dual Trace
Frequency & Period Counter
PU/DO Measuring Instrument
Decade Boxes
High Voltage Test Equipment

4. ASSOCIATED DRAWINGS

171-110-108	2SY110K8 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 and Timer

5. HIGH VOLTAGE TESTING

a) Apply 2KV RMS 50Hz for 1 minute between terminals listed in Table A strapped together and terminals listed in Table B strapped together.

b) Apply 3 5KV 1/50us impulses of each polarity between terminals listed in Table A strapped together and terminals listed in Table B strapped together.

(c) Apply 1KV RMS 50Hz for 1 minute between terminals in Table C strapped together and terminals in Table D strapped together.

A	B
1, 2, 3, 5, 6, 7, 8, 9, 10	15, 16, 17, 18, 19, 20 + earth
5, 6, 7, 15, 16, 17 + earth	1, 2, 3, 8, 9, 10, 18, 19, 20
1, 2, 3, 15, 16, 17, 18, 19, 20	5, 6, 7, 8, 9, 10 + earth

State	C	D
De-energised	16, 19	17, 20
Energised	16, 19	15, 18

6. CALIBRATION & TEST PROCEDURE

6.1 General

The phase angle measuring circuitry in this unit is fed from a low voltage (10 volt 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 pulse. The resultant output waveform is triangular with a linear rising edge and exponentially decaying trailing edge. The amplitude is proportional to the phase difference between the 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 is pulses edge clock a 3 stage binary counter to give a continuous “out of phase”

6.1 General (Cont)

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 10 volt transformer secondary winding. The DC outputs are each fed into two separate comparators to give a logic level corresponding to the following,

V Bus > 80% V Line > 80% V Bus > 15% V line > 15%

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

The timer on the voltage measuring board is initiated from the abovementioned 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 Circuit

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 pickup 1-10 sec operation.

c) Apply 110 Volt auxiliary supply between enclosure terminals 3 (positive) and 2 (negative).

d) Select switches dead bus and dead line.

e) Apply AC amplitude and phase variable supplies to the unit as per Wiring Diagram 171-110-108.

f) Set Bus input to 88 volts and adjust 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	Nominal	Maximum	Actual	Units
86	90	88		Volts

g) Set Bus input to 16.5 volts and adjust trimpot R27 (“B15”) until PCB pin 22 just goes high at this input voltage. i.e. PCB pin 22 high for V Bus < 16.5V.

Minimum	Nominal	Maximum	Actual	Units
15	18	16.5		Volts

h) Set line input to 88 volts and adjust R29 (“L80”) until PCB pin 13 just goes high at this

input voltage. i.e. PCB pin 13 high for V Line > 88V.

Minimum	Nominal	Maximum	Actual	Units
86	90	88		Volts

6.2 Calibration of 660/128-1 Voltage Sensing Circuitry (Cont)

h) Set Line input to 16.5 volts and adjust 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	Nominal	Maximum	Actual	Units
15	18	16.5		Volts

6.3 Calibration of 660/128-1 Timer

a) Initiate timer by taking PCB pin 8 to zero volts (connect to PCB pin 17).

b) Adjust trimpot R18 to give a scale ends minimum ratio of 10 : 1 as measured at PCB pin 11 irrespective of actual values.

c) Check the following accuracy initiating the timer via pin 8. Note that waveform period at PCB pin 11 at maximum time setting is approximately 2.441 ms.

Minimum	Maximum	Nominal	Actual	Unit
.7	1.3	1		Seconds
3.7	4.3	4.0		
6.7	7.3	7.0		
9.7	10.3	10.0		

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

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

b) Apply 110 volts 50 Hz to Bus and Line inputs. Set phase difference to zero. Measure by using a Dual Beam oscilloscope or Phase Angle Meter.

c) Check that IC1 pin 8 is high. If a small phase difference exists between the Bus and Line inputs a small negative going pulse of width equal to the phase difference will appear at pin 8. If either of the input transformers is incorrectly wired IC1 pin 8 waveform will be a square wave for the “in phase” condition.

d) Set trimpot to R22 to the middle of its range, and the dial setting pot (R21) to $50^{0.}$

d) Set incoming phase angle to 50^0 , and adjust trimpot R15 until PCB pin 6 just goes high (in phase condition).

f) Set incoming phase angle and dial setting pot to 10^0.

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

h) Set incoming phase angle and dial pot setting to 50^0.

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

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

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

7. GENERAL & FUNCTIONAL

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

b) Bus voltage greater than 88V and line voltage greater that 88V and inputs “in phase”.

Actual ☐

b) Bus voltage greater than 88V, Line voltage less than 16,5V and Dead Line select switch in.

Actual ☐

c) Line voltage greater than 88V, Bus voltage less than 16.5V and Dead Bus select switch in.

Actual ☐

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

PASS ☐

TESTED BY :_____ DATE :_____

8.0 CONNECTION DIAGRAM