Order Number | | Serial Number | |

PRODUCT/TEST MANUAL

2SY10N10

SYNCHRONOUS CHECK RELAY

Issue Level	Date	Summary of changes
A	19/07/1996	Initial issue.

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1. BROAD DESCRIPTION

The 2SY10N10 is a circuit breaker synchronism check interlock relay. If the input phase angle lies within both the acceptance and synchronous check settings, the timer will be initiated.

2. SPECIFICATIONS

Sensing Circuit VT's	
Nominal Volts	63.5 or 110V AC
Burden	> 1VA at nominal volts
Timer	0.25 - 10 Seconds
Phase Difference	5 - 40 & 30 - 65 degrees
Voltage Magnitude Difference	%5 - %50 V
Undervoltage Lockout	Set at 80% of nominal voltage
Auxiliary Volts	50 V DC

Contact Ratings

RL3, RL4 & RL5 — Contacts - 14 mil springs
Break 0.2A 240V DC Inductive
9A 240V AC

RL5 — MBO contact
Break 5A 240V DC inductive

RL1, RL2 & RL6
Break 2.5A 240V DC 50W max.

3. TEST EQUIPMENT REQUIRED

Doble
Digital Voltmeter
Oscilloscope, Dual Trace
Frequency & Period Counter
PU/DO Measuring Instrument
Decade Boxes
High Voltage Test Equipment

4. ASSOCIATED DRAWINGS

121-010-100	Master Circuit Diagram
651-215-208	Circuit Diagram Synchronous Check Phase 651-215-8
651-215-308	Loading Diagram for 651-215-208
651-215-209	Circuit Diagram for Acceptance Phase Board
651-215-309	Loading Diagram for 651-215-209
651-220-206	Circuit Diagram for the Timer Board
651-220-306	Loading Diagram for 651-220-206

5. HIGH VOLTAGE TESTING

a) Apply 2KV RMS 50Hz between all terminals tied together and frame for one minute.

b) Apply three 5KV impulses of each polarity between all terminals tied together and frame.

6. CALIBRATION & TEST PROCEDURE

6.1 Basic Operation of 2SY10N10

a) The unit is supplied with a 50 Volt DC auxiliary to terminal 9 (positive) and usually to terminal 3 (usually via a circuit breaker contact. In the "Acceptance angle lockout" mode operation is as follows.

b) 50 Volts positive to terminal 3.

c) Voltage is applied through RL4-1 to the "Start Relay".

d) DC supply and sensing voltages are supplied to the two Phase angle measuring boards via RL3 contacts.

e) If the phase angle of the input exceeds the "phase difference acceptance" setting, RL1 operates, allowing power to be applied to the delay operate relay RL4 (lockout) via RL5-2, RL1-3 and the acceptance angle lockout switch. If the input remains outside the "acceptance" setting for greater than the pick up time of RL4, this relay locks itself up via RL4-3 and drops out the start relay RL3, de-energising the electronic circuitry.

f) If the input phase angle lies within both the acceptance and synchronous check settings, Pin 6 goes high initiating the timer. Once RL5 has operated, RL5-2 prevents any possibility of lockout relay RL4 operating. RL5-1 ensures that the unit remains energised for the full output pulse duration (via RL5-2 from the auxiliary supply) and D3 ensure that if "out of phase" occurred whilst the output pulse was in progress the pulse would not be shortened.

g) If the input phase angle lies within the acceptance phase angle setting, but outside the synchronous check setting, no output will occur since RL2 will not be picked up and the timer will remain inhibited.

6.2 Calibration of Voltage Difference Detectors 651/215-8 & 651/215-9

Switch the "acceptance angle lockout" switch to the out position and apply 50 Volts positive to Terminal 3. RL3 should pickup which applies voltage to the sensing PCB's.

6.2.1 Input Voltage Decay Rate Adjustment

a) Connect both input transformers (110 Volt tap) to the one supply and set supply to nominal 110 Volts AC.

b) Using PCB Pin 18 as a reference, observe D101 and D102 cathodes using a dual trace oscilloscope.

c) Adjust R101 and R102 on both PCB's until the decay rate is the same at the two test points on each board. Check decay rate voltage at each point is 85mv +/- 5mv (peak to peak).

6.2.2 Summer Balance Adjustment

a) Observe IC2 Pin 6 on both PCB'S.

b) For each PCB adjust R109 and/or R112 so that the waveforms on IC2 Pin 6 for each board is symmetrical about its zero volt line Pin 18 and that the amplitudes for each board are the same (≅300mv peak to peak) square wave.

6.2.3 Voltage Difference Adjustment

a) Connect Input A and Input B to two adjustable set to 110 volts AC. Monitor the Input B voltage.

b) Set the undervoltage trimpots on 651/215-8 and 651/215-9 boards fully clockwise.

c) For the 651/215-8 PCB.

d) Set ***Positive Differential + Upper Limit*** fully anti clockwise.

e) Set ***Positive Differential + Lower Limit fully*** anti clockwise.

f) Set ***Negative Differential - Lower Limit*** fully clockwise.

g) Set ***Negative Differential - Upper Limit*** fully clockwise.

h) With voltage Difference pot set to 5% adjust Input B volts to 115.5.

i) Adjust *Positive Difference Lower* trimpot until RL2 chatters.

j) With voltage difference pot set to 50% adjust Input B volts to 165.0. Short out R19 to prevent
the undervoltage circuit operating RL2.

k) Adjust *Positive Difference Upper* Limit trimpot until RL2 chatters.
Repeat h) and k) until scale is calibrated.
Set dial to 5% and B voltage to 104.5 Volts.

l) Adjust *Negative Difference Lower* Limit trimpot until RL2 chatters.

m) With Voltage Difference pot set to 50% set Input B volts to 55.0 V.

n) Adjust *Negative Difference Upper* trimpot until RL2 chatters.

6.2.3 Voltage Difference Adjustment (Cont)

o) Repeat k) and n) until scale is calibrated.

p)

6.2.4 Results

a) Set input A at 80.0 volts and record Input B voltage at which RL2 chatters.

Setting	Minimum	Maximum	Nominal	Actual
5%	81	90	86	
20%	97	107	102	
35%	113	124	119	
50%	128	142	135	

b) Repeat for A input set to 100.0 volts

Setting	Minimum	Maximum	Nominal	Actual
5%	100	111	106	
20%	116	128	122	
35%	132	145	139	
50%	147	163	155	

c) Repeat for A input set to 120.0 volts

Setting	Minimum	Maximum	Nominal	Actual
5%	119	132	124	
20%	135	149	142	
35%	151	166	159	
50%	166	184	175	

d) Swap connections to inputs A and B so that Input B is held constant and input A is adjusted. Set Input B voltage to 80 volts and record Input A voltage at which RL2 chatters.

Setting	Minimum	Maximum	Nominal	Actual
5%	81	90	86	
20%	97	107	102	
35%	113	124	119	
50%	128	142	135	

e) Set B input volts to 100.0 and record Input A voltage at which RL2 chatters.

Setting	Minimum	Maximum	Nominal	Actual
5%	100	111	106	
20%	116	128	122	
35%	132	145	139	
50%	147	163	155	

6.2.4 Results (Cont)

f) Set B input volts to 120.0 and record Input A voltage at which RL2 chatters.

Setting	Minimum	Maximum	Nominal	Actual
5%	119	132	124	
20%	135	149	142	
35%	151	166	159	
50%	166	184	175	

g) Change input connections to the 63.5 volt tap. Set B input to 45.0 volts and record Input A voltage at which RL2 chatters.

Setting	Minimum	Maximum	Nominal	Actual
5%	46	51	48	
20%	55	61	58	
35%	64	71	67	
50%	73	81	77	

h) Set B input to 60.0 volts and record Input A voltage at which RL2 chatters.

Setting	Minimum	Maximum	Nominal	Actual
5%	60	66	63	
20%	69	76	73	
35%	78	86	82	
50%	87	96	92	

i) Set B input volts to 70.0 and record Input A voltage at which RL2 chatters.

Setting	Minimum	Maximum	Nominal	Actual
5%	70	77	73	
20%	79	87	83	
35%	88	97	92	
50%	97	107	102	

j) Swap input connections to A and B. Set input A to 45 volts and record input B voltage at which RL2 chatters.

Setting	Minimum	Maximum	Nominal	Actual
5%	46	51	48	
20%	55	61	58	
35%	64	71	67	
50%	73	81	77	

6.2.4 Results (Cont)

k) Set A input volts to 60.0 and record Input B voltage at which RL2 chatters.

Setting	Minimum	Maximum	Nominal	Actual
5%	60	66	63	
20%	69	76	73	
35%	78	86	82	
50%	87	96	92	

l) Set A input volts to 70.0 and record Input B voltage at which RL2 chatters.

Setting	Minimum	Maximum	Nominal	Actual
5%	70	77	73	
20%	79	87	83	
35%	88	97	92	
50%	97	107	102	

6.3 Undervoltage Lockout Adjustment on 651/215-8 and 651/215-9

a) Change input connections to the 110 volt tap.

b) Connect input A and B to the same supply adjusted to 88.0 volts.
Check that D3 and D4 anodes on 651/215-8 board are approximately 8 volts as observed on an oscilloscope.

b) Adjust trimpot R1 until relay RL2 just drops out and a 1 volt peak to peak saw-tooth appears at D3 anode.

OK ☐

d) Adjust trimpot R2 until the amplitudes of the waveforms are the same.

OK ☐

d) Repeat Steps b) to d) for the 651/215/-9 PCB adjusting R1 until RL1 picks up, adjust R2 as in d).

6.4 Calibration of Phase Angle Measuring for 651/215-8 and 651/215-9

6.4.1 Phase Difference Decay Rate

a) With no voltage applied to either A or B but with the 50 volt auxiliary applied, apply a temporary short across R23 to ensure that TR5 does not turn on. (under voltage lockout.) Link TR5 collector to ground.

b) Connect channel 1 of a dual trace oscilloscope to TR5 collector and channel 2 to TR13 collector. Adjust trigger on oscilloscope to trigger when the temporary short is removed from TR5 collector. Bridge out TR9 (collector-emitter) to hold TR10 off.

c) With a decade box select R40 so that the time delay between removal of the short (TR5 collector going high) and TR13 turning off is 30ms +/- 5ms.

Phase Difference Decay Rate (Cont)

d) Remove all bridges except the one across R23.

6.4.2 Phase Difference Detector

a) Connect Inputs A and B to separate supplies with phase shifting capabilities. Set both voltages to 110.0 volts and in phase.

b) Short R23 on each board during calibration - 651/215-8 and 9.

b) Set range switch to 40°. Set phase angle pot to 40°, apply phase shift to input and adjust trimpot R38 until output relay chatters.

c) Set phase angle pot to 5° and apply 5° phase shift to input. Adjust trimpot R30 until output relay chatters.

e) Repeat c) to d) until scale is calibrated.

f) Record results for Acceptance and Synchronous Check measuring circuits.

g) Acceptance (5^0 to 40^0 range).

Minimum	Maximum	Nominal	Actual	Units
3	7	5		Degrees
18	22	20		Degrees
38	42	40		Degrees

h) Acceptance (30^0 to 65^0 range)

Minimum	Maximum	Nominal	Actual	Units
27	33	30		Degrees
42	48	45		Degrees
62	68	65		Degrees

i) Synchronous Check (5^0 to 40^0 range)

Minimum	Maximum	Nominal	Actual	Units
3	7	5		Degrees
18	22	20		Degrees
38	42	40		Degrees

j) Synchronous Check (30^0 to 65^0 range)

Minimum	Maximum	Nominal	Actual	Units
27	33	30		Degrees
42	48	45		Degrees
62	68	65		Degrees

6.5 Calibration of Timer 651/220-6 .25 - 10 seconds

a) To facilitate calibration remove RL1 and RL2 from their sockets. Maintain the 50 volt auxiliary supply and initiate the timer by bridging PCB terminals 11 and 17 (use "power" connections on PU/DO unit).

b) Set dial pot to 10 seconds and adjust R9 to give a ten second output.

b) Set dial pot to .25 seconds and with a decade box across R5 select resistance to give .25 seconds output.

d) Repeat steps b) and c) until scale is calibrated. Replace decade box with nearest preferred resistor value, recheck scale accuracy. Tabulate the results.

Minimum	Maximum	Nominal	Actual	Units
		.25		Seconds
1.6	2.4	2		Seconds
3.6	4.4	4		Seconds
5.6	6.4	6		Seconds
7.6	8.4	8		Seconds
9.6	10.4	10		Seconds

e) Check that the output pulse is 2 seconds +/- .5 seconds.

[ ] Seconds

7. GENERAL & FUNCTIONAL

a) Operate Time of RL4
The pickup time of the Lockout relay must not be greater than 200ms at 40 volt auxiliary, otherwise when the unit is energised and the input phase angle exceeds its set value for accept angle lockout "on" and the timer set to .25 sec, time-out rather than lockout would occur.

b) 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