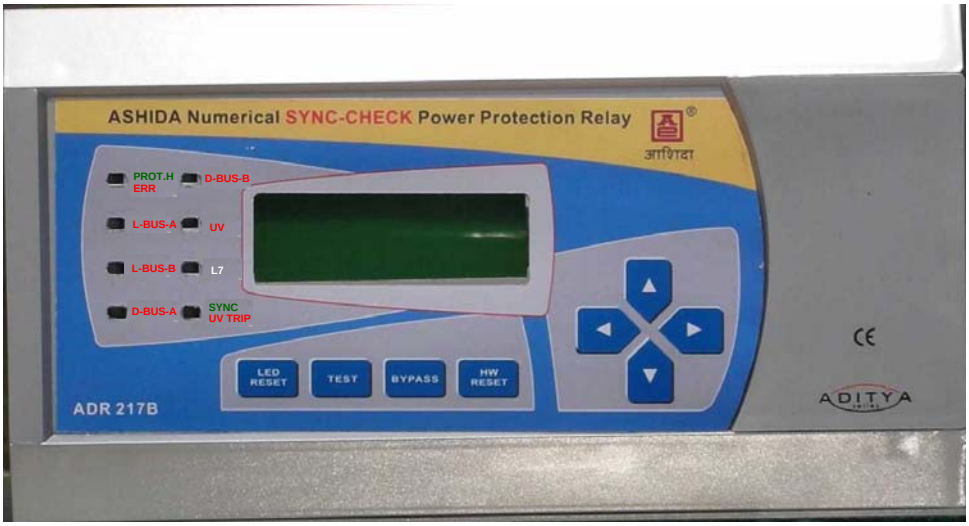
ASHIDA Numerical Sync-Check Power Protection Relay

Type: ADR217B
(ADITYA–V2 Series)



Features:

- ✓ Definite Time Sync-Check Protection for paralleling two power source.
- ✓ Phase angle limit is adjustable over the range of 1 to 90 degrees.
- ✓ Time delay is adjustable over a range of 1 to 99 cycles or 0.1 to 99 seconds.
- ✓ Voltage monitoring circuits provide independent determination of Bus-A and Bus-B or Bus-A to Bus-B voltage levels for selectable closing conditions.
- ✓ Voltage difference provides additional verification of proper breaker closing conditions.
- ✓ Large 20x4 LCD display for Parameter and setting display
- ✓ Fully communicable with IEC standard open protocol.
- ✓ Separate Communication Prot for SCADA (RS485) as well as Local testing (RS232C)
- ✓ Very low burden on PT (less than 0.2VA)
- ✓ Online display of line voltage and bus Voltage, CB status and other digital and physical status.
- ✓ Continuous monitoring of module's internal hardware and alarm generation in case of failure of any critical components.
- ✓ Digital Output contacts for local alarm as well as tele-signalling
- ✓ 9 Optically isolated digital status input for monitoring of status and avoid used of external relay logic
- ✓ 100 nos of event memory Sync digital status change relay pkp etc. All events are with date and time stamped up to 1ms.

Note: Due to our policy to upgrade our products constantly, we reserve the right to supply products which may vary slightly from that indicated above.

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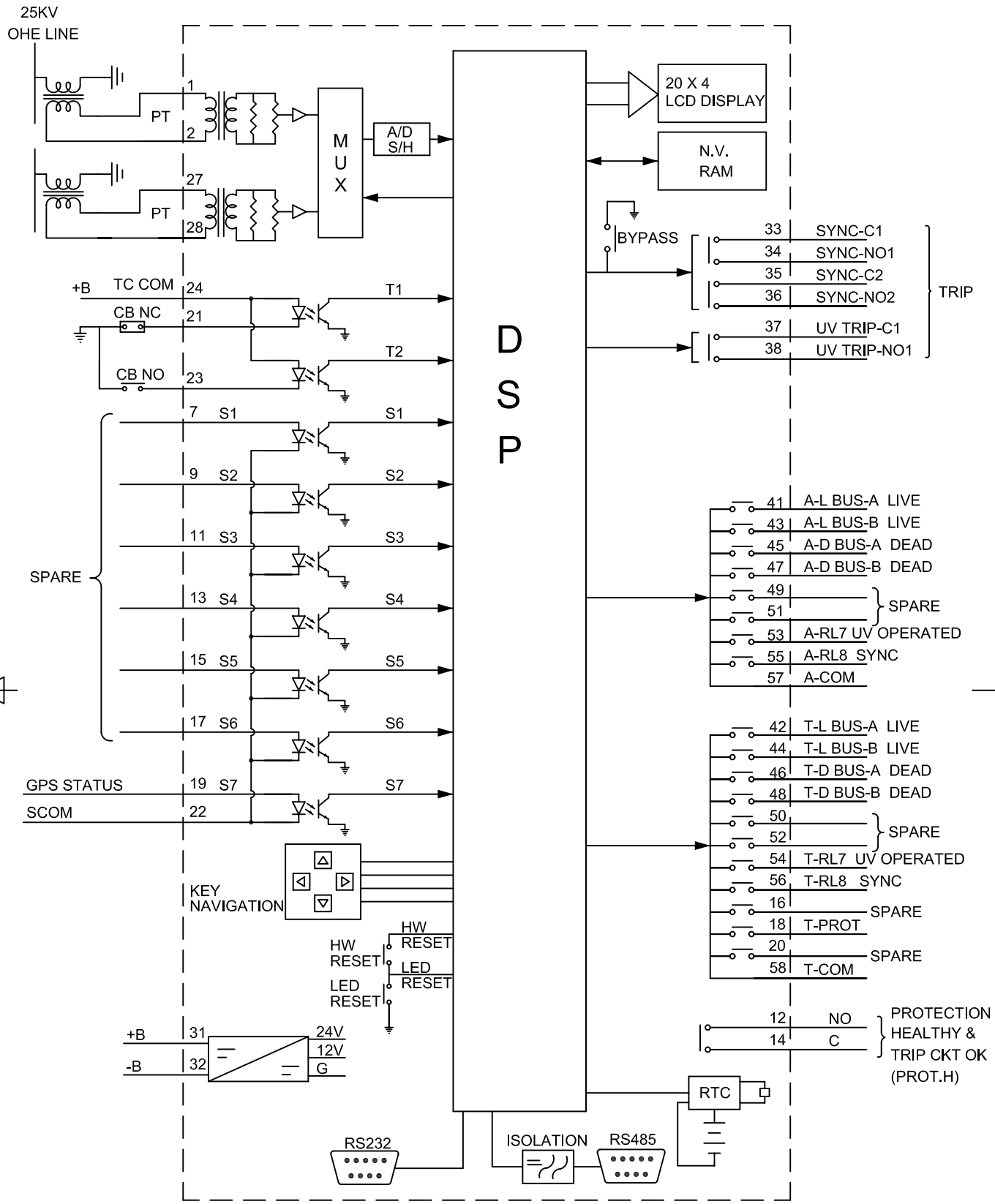
RevNo	Revision note	Date	Signature	Checked



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Title : - BLOCK DIAGRAM FOR ADR217B
SYNC-CHECK POWER PROTECTION RELAY

Drawing__ Ref. ABD00601 | Edition 00 | Sheet 1 OF 1

1. *Description:*

ADR217B is second generation Numerical sync check Relay. It consists all the necessary protection and monitoring functions required for synchronising two power sources. The general block diagram of internal hardware of relay is as shown in ref. Drawing ABD00601

1.1 DSP controller: - The High speed Digital Signal Controller is 16bit fix point DSP having all the features of DSP and microcontroller thus commonly known as DSC (Digital Signal Controller). The DSC continuously monitors voltage signals, along with different status input, through PTs and optical isolated status connections. The high-speed micro-controller samples these voltage signals through a **A/D converter**. The Digital Signal performs powerful **Numerical Algorithms** to find out real and imaginary portion of complex voltage, All measurement is tuned to fundamental frequency i.e 50Hz, thus relay remain stable during distorted waveform generated electronics loco-motive. All these measure values are then used for protection function.

1.2 Analog Measurement and data acquisition:- The two voltages are measured through external PTs. Further these signals are converted in low level signal through internal voltage transformer. These Analog signals are pass through anti aliasing filter which remove all high frequency distortion and limit bandwidth. These sine wave signals are then applied to ADC converter through Analog multiplexer. The ADC converter is having 14 bit resolution with internal sample and hold arrangement. The DSC takes 16 samples per cycle of power line frequency.

1.3 Power supply section:- The power supply module is a specially designed robust DC – DC converted designed using modern PWM based Switching mode technique. It converter 110Vdc station battery supply to the 12V and 24Vdc low voltage supply for relay electronics and control circuit. It also provides necessary isolation from station battery. The Normal operating voltage range is 77Vdc – 260Vdc. The ADR217B is having special relay contact marked as PROTH if any thing goes wrong in power supply module then this contact become open can be used to provide local as well as remote Telesignalling ALARM.

1.4 Digital input digital output section (DIDO) :- The ADR217B is having 9 digital inputs and 10 digital output contact (control contact). These are software control input and outputs. As railway application is pre defined and well standardised, these input

and outputs are pre programmed in factory as per the system requirement to avoid any wrong configuration by user. The arrangement of all inputs is as given in table.

Input	Function
T1	Connected to CB NC
T2	Connected to CB NO
S1-S6	SPARE not used
S7	For GPS time Sync.
SCOM	Is as common must be connected to B-
TC COM	Common for T1,T2 to connected to B+

The Output configuration of ADR217B is as given in table. The only outputs which are used are mentions rest are spare.

Output	Contact Combination	Function
Synch	2NO	Closer Allow
Live Bus-A	1NO for ALARM 1NO For Tele-Signalling	Bus-A voltage is above this setting.
Live Bus-B	1NO for ALARM 1NO For Tele-Signalling	Bus-B voltage is above this setting.
Dead Bus-A	1NO for ALARM 1NO For Tele-Signalling	Bus-A voltage is less than this setting.
Dead Bus-B	1NO for ALARM 1NO For Tele-Signalling	Bus-B voltage is less than this setting.
Synch	1NO for ALARM 1NO For Tele-Signalling	Closer Allow
T COM	-	Common for Tele-signalling
A COM	-	Common for ALARM

1.5 Communication Section: - The ADR217B has two communication port, 1 RS232C on Front and 2nd RS485 at rear. The unit use IEC870-5-103 communication protocol.

1.6 Human Interface:- The For Operator interface The ADR217B is provided with 20x4 Large backlit LCD display and 8 Nos. of soft feather touch keys and 8 bi-color LEDs. The display shows all setting, measured and computed parameter, logical and digital status, and setting. The 4 keys are provided for display navigation 1 key for LED reset, 1Key for Trip Test, 1 key for Hardware reset and 1key for bypass. All the settings are password protected. Trip test can be blocked via setting. The detail steps for setting of unit is out of the scope of this document. It will be given in operating manual.

1.7 Constructional Details:- The relay is designed in flush mounding cabinet. The overall size of cabinet is 260 x 140 x 190

mm Ref. diagram MAC01302. The IP class of the relay is IP44. The relay electronics is divided in to 4 PCB and one power supply module. The 2 PCBs at terminal side of cabinet connected in back to back. The Back PCBs are mainly consist of electromechanical element, opto isolators etc. The 2 PCBs are at front side of unit which consist of display, keyboard and DSP controller, associated Analog and digital circuits. The both sets of PCBs are connected together via flat FRC type cable. The lay-out of electronics is such that it avoid all wiring of high frequency and analog signals. The power supply module is separate and convert 110Vdc signal to 24V and 12V dc value. The module is ASHIDA make. For external interface the relay is provided with 2 terminal blocks. Each terminal block is having 28 terminals, thus there are total 56 terminals. Each terminal is coved with high grade insulating material. Further extras dummy terminals are provided between PT and other circuit to avoid any flash over. ***The terminal block is removable which make relay draw-out.***

1.8 Self Check Feature:- The DSC used in relay is having major of it component are with in the chip. The controller check all the components which are outside of chip such as ADC, Non volatile memory use for data storage, non volatile memory used for relay setting, real time clock etc. The any hardware is detected as fault the relay change contact marked as PROTH and display error code on LED display. Depend upon the component relay take necessary action. Following table summarised the type of fault and action taken by relay

Type of Fault	***Action***
ADC Error	Most critical Error. Relay give error message and change PROTH contact
NV RAM used for disturbance record	Generate Error signal and remain in protection change PROTH contact
NV RAM use for setting	Generate Error signal and remain in protection by assuming default setting value. change PROTH contact
Setting Error	Generate Error signal and remain in protection by assuming default setting value. change PROTH contact
RTC Error	Generate Error signal and remain in protection change PROTH contact

1.9 Monitoring Functions (Event, Record):-

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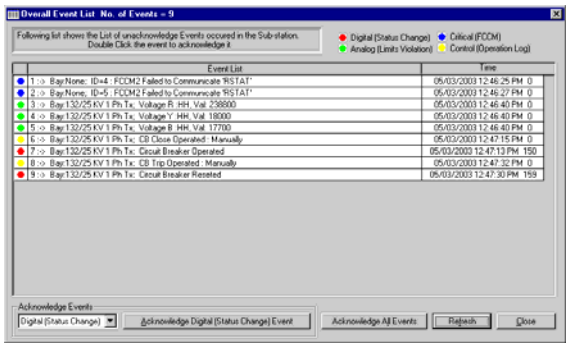
Apart from basic protection functions. Relay is continuously monitors its internal and external hardware through different status flags.

There are two types of status flags 1) Logical status such relay Relay Pick-up, Relay, operation, setting change etc. these are generated with in relay.2) Similarly there are opto-coupler inputs which are connected to external contacts marked as T1,T2, and S1 – S6. Any change in logical or physical status is recorded as event.. Such event are kept in internal non volatile memory along with time stamp. Up to 100 such event can be store in relay memory. These event can download for detailed analysis of any operation. This event list can be downloaded through software for details analysis.



2. Main Functions

The primary application of this relay is in situations that require verification that synchronism exists prior to closing a circuit breaker. These include the paralleling two power source or to a system, reestablishing an interconnection between two parts of a power system such as two traction substation are to be connected in parallel by closing SP breaker.

The ADR217B is a numerical discrete synchronism check relay, designed to permit breaker closure only after the specified phase angle conditions have been verified and the condition satisfied for a specified time period. The design provides for ease of setting the phase angle and time period requirement through front panel keyboard. The design also includes up to five optional voltage-measuring circuits to verify various line and bus voltage conditions prior to permitting breaker closure.

The ADR217B Sync-Check relay is designed to measure the voltage difference and phase angle between the TSS A and TSS B sides of a SP breaker. The relay verify this angle and voltage difference, if it is less than or equal to the front panel setting for more than time period defined by the front panel setting. Relay allow closer.

The Relay will allow the closer of CB if following criteria is meet.

- Phase angle between Bus – A Voltage and Bus-B voltage is with in set band.
- Voltage difference between Bus-A and Bus-B voltage should be less than set ΔV
- The Bus-A and Bus-B voltage should be more than live Bus-A and live Bus-B voltage setting.
- One of the Bus is dead.

The relay has special under voltage setting denoted as dead Bus-A and dead Bus-B having separate contact if both voltages are less than

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this setting relay change respective contact which above dead level then relay reset. can be utilised to trip breaker. If any of voltage is

Technical Specifications:

General specifications			
Sr. No.	**Specification**	**Particulars**	
I.	Voltage input	: Suitable for PT secondary 110Vac	
II.	Aux. Supply	: 77 - 250VDC.	
III.	VA burden on Aux.	: Less than 5 Watts (Non tripping condition);	
IV.	VA burden on PT	: Less than 0.2 VA	
V.	Operating Temp. range	: 0 deg. To + 65 deg.	
VI.	Continuous Current carrying capacity	: 2 x of rated	
VII.	Thermal With stand for CT	: 20 x of rated for 1.0 sec.	
VIII.	Continuous voltage rating	: 1.5 x of rated	
IX.	Thermal With stand for PT	: 2 x of rated for 1.0 sec.	
X.	Output Trip Contact	: 2No For Sync / 1 NO for UV trip	
XI.	Rated Continuous	: 5A	
	Making Capacity	: 30A for 1 sec	
	Breaking	: 5A AC Resistive 0.5A Inductive	
XII.	Alarm And Tele signalling Contact	: 1 NO For Alarm : 1 NO For Tele Signalling : Total 8 Relay Alarm duty	
Accuracy and Measurement Range:			
XIII.	Voltage	: 0.5V – 125Vac With +/- 5%	
	Phase Angle	: 0 – 360 deg with +/- 1 deg	
	Operating Frequency	: 47Hz – 52Hz	
Settings			
XIV.	Allowed phase angle	: Delta A	– 00.0-20.0 deg. In steps of 0.5 deg
	Allowed Voltage difference	: Delta V	– 00 – 110V in steps of 1V
	Live Bus-A voltage	: L-Bus-A	– 50 – 110V in steps of 1V
	Live Bus-B voltage	: L-Bus-B	– 50 – 110V in steps of 1V
	Dead Bus-A voltage	: D-Bus-A	– 0 – 110V in steps of 1V
	Dead Bus-B voltage	: D-Bus-B	– 0 – 110V in steps of 1V
	Time	: TT	– 0.1 – 99.9 sec in steps of 0.1 sec
	UV Trip	: UV	– 0 – 110V in steps of 1V
	UV Time	: UV Time	– 0.1 – 99.9 sec in steps of 0.1 sec
XV.	Operational Indicators (Flags)		

Note: Due to our policy to upgrade our products constantly, we reserve the right to supply products which may vary slightly from that indicated above.

	PROTH/ ERROR	: Green LED indicates Relay OK : In case of following condition led become off 1. Problem in relay Hardware. 2. Auxiliary supply is not sufficient for relay operation. :Red LED indicate Error	
	Sync /UV Trip	: Green LED allows closer, Self Reset (SR) Type. : Red LED indicate UV trip (SR) Type	
	L-Bus-A	: Red LED Indicate Bus-A Voltage is above L-Bus-A level SR type	
	L-Bus-B	: Red LED Indicate Bus-B Voltage is above L-Bus-B level SR type	
	D-Bus-A	: Red LED indicate Bus-A voltage is less than D-Bus-A level SR type	
	D-Bus-B	: Red LED indicate Bus-B voltage is less than D-Bus-B level SR Type	
	UV	: Red LED indicate Under Voltage Trip	
XVI.	Drawing References	: For Block Diagram	- ABD00601
		: For Back Terminal	- RLY00601
		: For Cabinet Type	- MAC01302
		: For Drawout Details	- MAC01303

Type Test:-

I.	High Voltage Test	: IEC 60255-5. class - III : At 2.5kV 50Hz between all terminal connected together and earth for 1 minutes
II.	Impulse Voltage Test	: IEC60255-5. class - III : *Test voltage:* 5KV (peak) 1.2 / 50us, : *Energy* :0.5 J, : *Polarity :* + ve and – Ve : *Nos. of impulses :* 3 positive and 3 negative impulse : *Duration between Impulses :* 5 sec.
III.	High Frequency test	: IEC 60255-22-1 : *Frequency* : 1MHz Damped Oscillatory : *Mode : Common Mode: 2.5kV 3 pulses* : *Differential Mode* : 1.0kV 3 pulses : *Duration* **:** 2 sec
IV.	Vibration Test	: IEC 60255-21-1 class 1 : Frequency Range = 10Hz – 150Hz , acceleration. = $1g_n$ (9.8 m/s^2) : Sweep rate 1 octave/min; 20 cycle in 3 orthogonal axis.
V.	Dry heat test	: IEC60068 -2-2
VI.	Damp Heat test Steady state	: IEC60068-2-3
VII.	Damp Heat test cyclic	: IEC60068-2-30
VIII.	Interference suppression	: IEC 60255-22-1
IX.	Immunity to Electro static	: IEC 60255-22-2 Class III and IEC 61000-4-2 class III.

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	Discharge	: *Contact discharge*: 6kV, : *Air discharge:* 8KV : *Polarity*: both +ve and –Ve polarities.
X.	Immunity to Radiated EM energy	: EN 61000-4-3 : Frequency 80MHz – 1GHz , 10V/m Antenna, 2 minutes for all sides.
XI.	Electrical Fast transient interference/bursts	: IEC 60255-22-4 and IEC 61000-4-4, class A : *Pulse* : 5/50 nSec :*Mode* : Differential and Common : *Pulse Amplitude* 4kV : *Pulse Repetition Rate* : 2.5kV : *Polarity*: Positive and Negative : *Duration*: 60 sec
XII.	Serge Immunity Test	: IEC 60255-22-5 / IEC 61000-4-5 : *Pulse* : 1.2/50 uS : *Mode* : Differential and Common : *Differential Mode* = 1kV : *Common Mode* = 2kV : *Nos. Of transient :* 5 in each mode
XIII.	Immunity to Conducted Disturbances induced by Radio Frequency field	: IEC 60255-22-6 : *Freq.* 150kHz – 80MHz, : *Modulation :* 80% AM @ 1 KHz *Amplitude* : 10 V,
XIV.	Power Frequency Magnetic field Immunity Test	: BSEN 61000-4-8 1994 : *Magnetic Field :* 100A/m and 1000A/m *: Frequency:* 50Hz *: Duration:* 100A/m for 1 minute 1000A/m for 3 sec.
XV.	AC Ripple in DC supply Test	: IEC 60255-11

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Revision Note

Rev. No	Date	Description
1	26 Jan 2007	Original Draft specs
2	15 Jun 2007	RDSO comments implemented
3	28 Nov 2007	RDSO comments implemented and finalised
4	19 Jun 2010	Modify for general utilities

RevNo	Revision note	Date	Signature	Checked
01	Original	26.01.07	SMK	
02	Modification as Per RDSO comments	15.06.07	SMK	

SYNC-CHECK POWER PROTECTIONI RELAY Type: ADR 217B

T1

PT-1-P1	1	2	PT-1-P2
*	3	4	*
*	5	6	*
S1	7	8	*
S2	9	10	*
S3	11	12	NO
S4	13	14	C
S5	15	16	*
S6	17	18	T-PROT.H
GPS STATUS	19	20	*
TC1 CB - NC	21	22	SCOM (-VE)
TC2 CB - NO	23	24	TC COM (+VE)
*	25	26	*
PT-2-P1	27	28	PT-2-P2

SPARE: S1, S2, S3, S4, S5, S6

NO, C: PROT.H

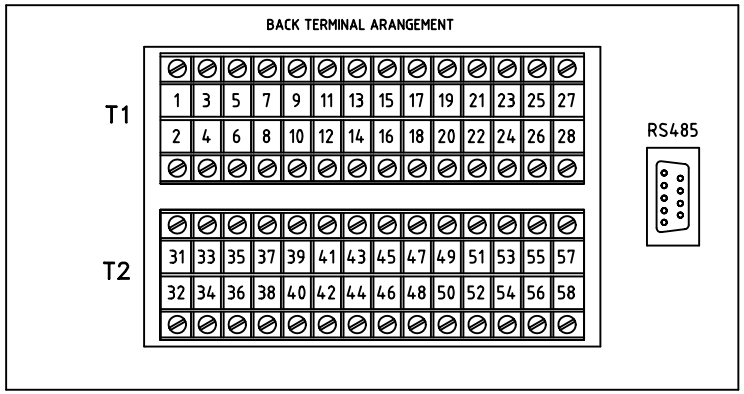
T2

B+	31	32	B-
SYNC-C1	33	34	SYNC-NO1
SYNC-C2	35	36	SYNC-NO2
UV TRIP-C1	37	38	UV TRIP-NO1
*	39	40	*
A-L BUS-A LIVE	41	42	T-L BUS-A LIVE
A-L BUS-B LIVE	43	44	T-L BUS-B LIVE
A-D BUS-A DEAD	45	46	T-D BUS-A DEAD
A-D BUS-B DEAD	47	48	T-D BUS-B DEAD
A-RL5	49	50	T-RL5
A-RL6	51	52	T-RL6
A-RL7 UV OPERATED	53	54	T-RL7 UV OPERATED
A-RL8 SYNC	55	56	T-RL8 SYNC
A-COM	57	58	T-COM

SPARE: A-RL5, A-RL6

SPARE: T-RL5, T-RL6

BACK TERMINAL ARANGEMENT



NOTE:

1. **B+ (31) & B– (32) ARE TERMINALS FOR AUXILIARY SUPPLY 110Vdc.**
2. **PROT.H = PROTECTION HEALTHY.**
3. *** Terminals not used**

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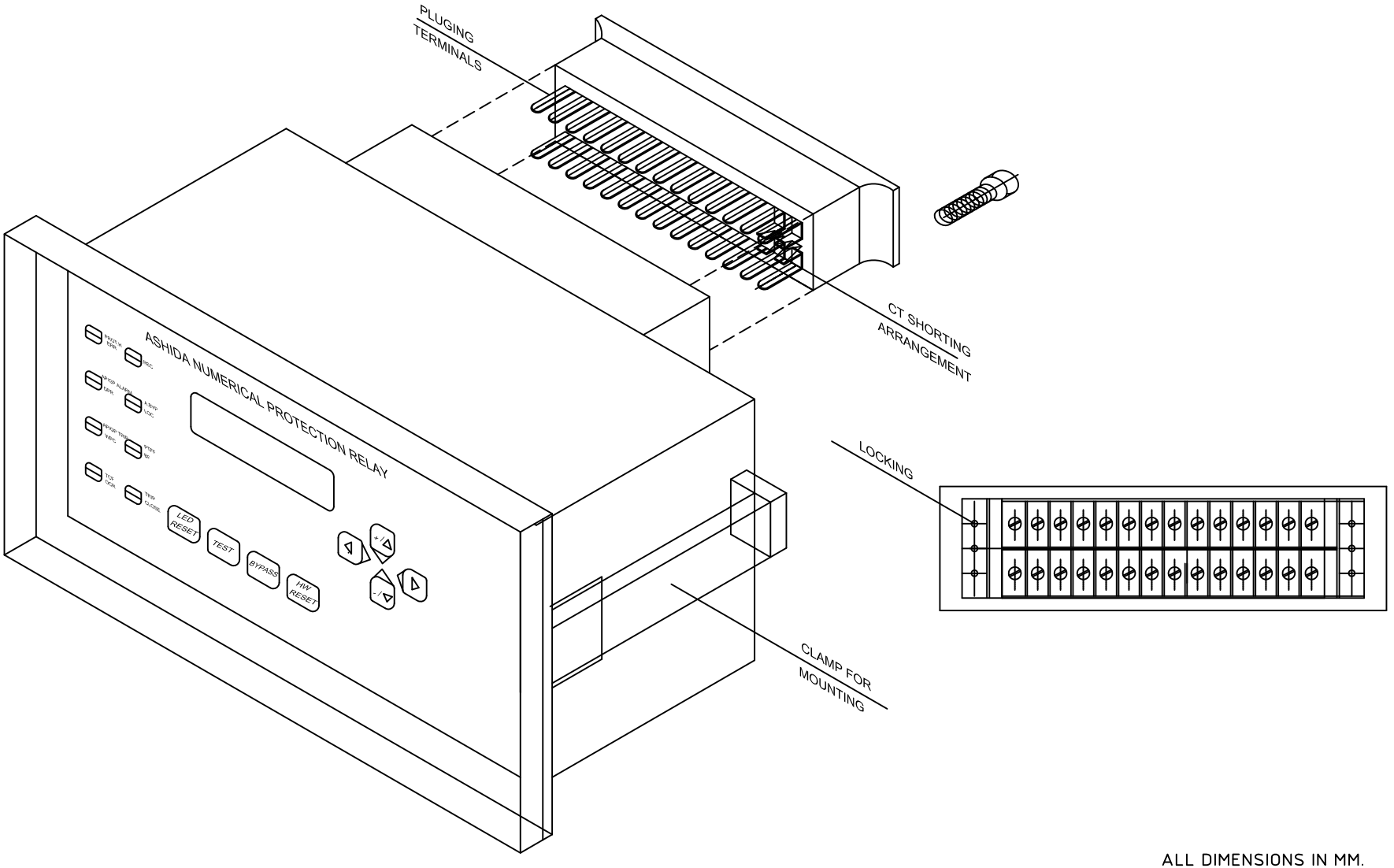
Title : - BACK TERMINAL CONNECTION FOR ADR217B
SYNC-CHECK POWER PROTECTIONI RELAY

Drawing __ Ref. RLY00601 | Edition 02 | Sheet 1 OF 1

RevNo	Revision note	Date	Signature	Checked



ALL DIMENSIONS IN MM.

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TITLE : - ISOMETRIC VIEW OF CSE (DRAWOUT)

Drawing __ Ref.:- MAC01303 | Edition 00 | Sheet 1 OF 1