

ISO 9001:2015	Effective from: 24/06/2024	RDSO/SPN/TC/62/2008	Revision 4.1
Specification for Digital Clock with GPS Synchronization			

GOVERNMENT OF INDIA, MINISTRY OF RAILWAYS



सत्यमेव जयते

Specification for

Digital Clock with GPS Synchronization

Specification No. RDSO/SPN/TC/62/2008 Revision 4.1

Issued by

SIGNAL & TELECOM DIRECTORATE

(TELECOM SECTION)

RESEARCH DESIGNS & STANDARDS ORGANISATION

MANAK NAGAR, LUCKNOW-226011

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I. AMENDMENT HISTORY:

Version	Revision	Effective Month/Year	Reason for Amendment
RDSO/SPN/TC/62/2006	Revision 0	August 2006	FIRST ISSUE
RDSO/SPN/TC/62/2006	Revision 1.0	December 2006	Clause modified: Clause No. 4.0 to 4.3 & 4.6 Clause added: Clause No. 4.4 & 4.8 to 4.10
RDSO/SPN/TC/62/2007	Revision 2.0	November 2007	Clause modified: Clause No. 1 to 2 & 5 to 11 Clause added: Clause No. 3 & 12 to 19
RDSO/SPN/TC/62/2008	Revision 3.0	July 2008	Clause deleted: Clause No. 5.12, 5.13, 6.5 & 7.16
RDSO/SPN/TC/62/2008	Revision 3.0 Amendment No.1	September 2011	Clause modified: Clause No. 11.3
RDSO/SPN/TC/62/2008	Revision 3.0 Amendment No.2	November 2016	Clause No. 20 added pertaining to QO-D-7.1-11 dated 19.07.2016 namely “Vendor Change in approved Status” in compliance to Vigilance/RDSO directives.
RDSO/SPN/TC/62/2008	Revision 4.0	June 2024	Clause modified: Clause No. 1, 2, 3.5, 3.17, 4.1, 4.2, 4.5, 4.5.4, 5.8, 5.15, 5.16, 6.7, 6.8, 6.9, 8.1.1, 8.1.4, 8.1.5, 8.1.6, 8.1.7, 8.1.8, 9.2, 9.3, 9.6, 10.1.4, 10.2.2, 11.2, 11.4.1, 11.4.3, 11.7.1, 15.1, 18, 19 & Clause No. 20 Clause deleted: Clause No. 3.13, 3.21, 3.22, 4.6, 5.11, 6.4 & 7.1 to 7.23 Clause added: Clause No. 7.3, 10.4.4 & 10.7.2
RDSO/SPN/TC/62/2008	Revision 4.1	June 2024	Typographical error removal in Clause No. 5.2 & 5.4

II. DOCUMENT DATA SHEET:

Document Number	RDSO/SPN/TC/62/2008 Revision 4.1
Document Title	Digital Clock with GPS Synchronization
Prepared by	Director/Telecom-I
Approved by	PED/S&T
Abstract: This document specifies technical specification of Digital Clock with GPS Synchronization.	

III. DOCUMENT CONTROL SHEET:

DESIGNATION	ORGANIZATION	FUNCTION	LEVEL
JE/Telecom	RDSO	Member	Prepare
Director/ Telecom-I	RDSO	Member	Prepare/Review/Issue
PED/S&T	RDSO	Approving Authority	Approve

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V. SUMMARY:

This document covers the technical requirements of Digital Clocks with GPS Synchronization consisting of digital clocks suitable for platform area & office complexes of Indian Railways.

VI. SOURCE:

Draft specification RDSO/ SPN/ TC/ 62/2008 has been prepared by RDSO, Lucknow as per Railway Board letter No. 2004/Tele/TCM/1 dated 27/12/2005.

VII. FOREWORD:

RDSO/ SPN specification is issued as draft specification. This specification is circulated to customers/ Railways and field inspection units for comments.

In the absence of IRS specification, procurement may be made as per RDSO/ SPN specification.

This specification requires the reference to the following specifications:

IRS: S23	Electrical signaling and interlocking equipment
RDSO/SPN/144	The Safety and reliability requirement of electronic signaling equipment
IS:9000	Basic environmental testing procedures for electronic and electrical items

Wherever, reference to any specifications appears in this document, it shall be taken as a reference to the latest version of that specification unless the year of issue of the specification is specifically stated.

For the purpose of this specification, the terminology given in IRS: S23 and RDSO/SPN/144 shall apply.

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1. SCOPE:

The specification of Digital Clock covers technical requirement of GPS synchronized clock. These clocks are used for displaying correct times at various locations on platforms, in the control & other offices of Railways. It also covers the technical requirement of GPS receiver to be used for synchronization of digital clock.

2. SYSTEM DESCRIPTION:

The digital clocks shall use Global Positioning System (GPS) receiver to receive correct time. The clocks shall have local battery backed Real Time Clock (RTC) which shall be synchronized to the time information received from the GPS. In case of failure of GPS system, the clock's local RTC time shall be displayed.

The digital clocks shall have a built-in GPS receiver and shall synchronize time as received from the GPS.

3. GENERAL SPECIFICATION:

- 3.1 It should be possible to suspend or mount digit clocks below shade/roof of platforms, station buildings or on a wall or inside a concourse/ main entry of railway station/ buildings.
- 3.2 The digital clocks shall be dust proof, weather proof, water proof and vibration proof as per IP 54.
- 3.3 Display on the digital clock shall be flicker free.
- 3.4 The display on a digital clock shall be immune from the effect of 25 KV traction line or electro-magnetic induction or any other electro-static induction.
- 3.5 Digital clock shall be covered with U.V. stabilized polycarbonate sheet with thickness of 3mm \pm 0.3mm in order to give good visibility and protection against dust. Single polycarbonate sheet without any joint should cover the clock.
- 3.6 LEDs with equal fringe and uniform intensity are to be used to ensure that the timing to be displayed is with excellent contrast so that no black patches are visible on the display screen of clock.
- 3.7 Digital clock shall be constructed using PCB module of LED matrix. The mechanical mounting of these modules shall be such that easy replacement of PCB module is possible in case of repair. Such replacement shall not call for removing any other PCBs.
- 3.8 The construction of the whole unit of digital clock should be modular, such that any module (i.e. PCB, connector, cable, power supply unit etc.) can be easily removed when defective and a fresh module is fixed to make the system functional again. Wiring between different modules should be done with the help of male/female type of connectors. There should not be any requirement of rewiring, re-soldering/ de-soldering or opening and reconnections of wiring etc. during the maintenance, unless there is damage to the wiring. Proper cable guides are to be provided inside the digital clock for drawing cables and wires neatly.
- 3.9 In digital clock, CPU card, driver modules & power supply modules should be easily accessible. LED modules should be accessible from front side.

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- 3.10 The relevant ICs for the digital clock should preferably be of surface mounted device (SMD) to ensure high reliability.
- 3.11 Digital clock shall be capable of working in an ambient temperature range of -10°C to $+70^{\circ}\text{C}$ and relative humidity up to 95% at ambient temperature of 40°C without any degradation.
- 3.12 There should be in-built power supply to work directly on 230V AC with short circuit protection with properly rated fuse at its input.
- 3.13 The digital clock should not display any garbage. All the embedded boards with CPU should have watchdog circuit, which should reset the processor in case the processor goes haywire due to any external disturbance caused by high voltage traction etc.
- 3.14 Material used for the printed circuit board (PCB) shall be copper clad glass epoxy of grade FR-4 or equivalent. The thickness all PCBs shall be minimum 1.6 mm.
- 3.15 CONFORMAL COATINGS: Assembled and tested printed boards should be given a conformal coating to enable them for functioning under adverse environmental conditions. The coating material should be properly chosen to protect the assembly from the following hazards.
- a) Humidity
 - b) Dust and dirt
 - c) Airborne contaminants like smoke and chemical vapors
 - d) Conducting particles like metal clips and filings
 - e) Accidental short circuit by dropped tools, fasteners etc.
 - f) Abrasion damage
 - g) Vibration and shock (to a certain extent)
- 3.16 The solder masks (green/black) shall be applied on the solder side and component side of the card & black masking shall be applied for LED module part.
- 3.17 Following description shall be etched on the component side of the PCB:
- a) Component outline in the proximity of the component
 - b) Manufacturer's name
 - c) PCB name
 - d) Part number
- 3.18 Following description shall be engraved on the PCB:
- a) The manufacturing serial number
 - b) Month and year of manufacture
- 3.19 The display shall be preferably static driven. If multiplexing is used, it should be on digit-by-digit basis and refreshing time should not be more than 20 ms.

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4. SPECIFICATION OF LED:

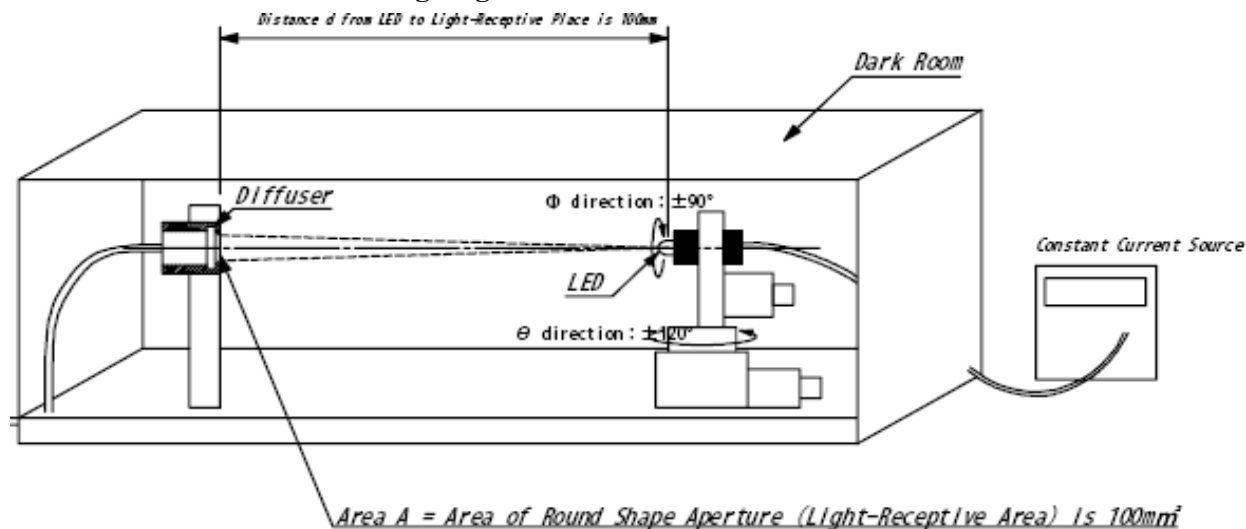
4.1 Cool White color Chip Type SMD LEDs of uniform intensity shall be used for better visibility in in all types of digital clocks. However Amber Colour SMD LED may be used in all types of digital clocks, if specified by the Railways/Purchaser. The intensity of the illumination should be such that it shall be possible to read the clock timings clearly from a distance of minimum 50 meters. This visibility is to be checked and ensured for that part/spot of clock which has maximum intensity of ambient light.

4.2 LED Specification:

Diffused Chip Type SMD LED should meet following parameters.

S.No.	Parameters	White LED	Amber LED
1	LED Type & Size	Chip Type SMD 3.6mm x 3.6mm (Overall max. dimension)	
2	Colour	White	Amber
3	Wavelength	Color Temperature 6500°K \pm 10 %	595 \pm 7nm
4.	Viewing Angle (50% I _V in mcd)	Minimum 90°	
5	Luminous Intensity @ 20mA biased current	\geq 1500 mcd	\geq 500 mcd
6	Make	Avago / Nichia / Osram/ Everlight/ CREE	

4.3 Measurement of Viewing Angle of LED:



4.3.1 Connect the LED under test as shown in the above set up in a dark room.

4.3.2 Bias the LED such that the rated current flows in the LED under test.

4.3.3 Adjust the distance between the tip of the LED and Chromo meter or Spectrometer diffuser to 10 cm exactly.

4.3.4 Place the Chromo meter or Spectrometer to measure the intensity in Lux in the position indicated in the setup. Rotate the LED so that the chromo meter or Spectrometer records maximum Lux. Record this value and position of LED in degrees.

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4.3.5 Rotate the LED in Horizontal (X-direction) to a point, at which the Lux reading is half of the value that was observed in the clause 4.3.4. Record the position of LED in degrees. Calculate the degrees the LED was rotated from the maximum intensity value to half intensity value. Record this value as θ_a (Theta). Similarly rotate the LED in opposite direction from the maximum intensity value and mark the point where the Lux value observed is half the value to the one observed in the center. Calculate the rotation in degrees from maximum Lux value and record this value as θ_b .

4.4 Calculation of dispersion Angle:

$$\text{Dispersion Angle} = \theta_a + \theta_b$$

4.5 Intensity Measurement of LED:

4.5.1 Connect the LED under test as shown in the above set up in a dark room.

4.5.2 Bias the LED such that the rated current flows in the LED under test.

4.5.3 Adjust the distance between the tip of the LED and white board to 30 cm exactly.

4.5.4 Use the Chromo meter or Spectrometer to measure the intensity in Lux at the center of the pattern formed on the white board due the illumination of the LED. The Value of the Lux observed at the center of the Pattern on the white board is the intensity of the LED in Lux.

4.5.5 Intensity of LED (mcd) = 92.9 * Lux value observed.

4.6 Biasing of the LED:

In no case the average forward current shall exceed the limit as specified by the manufacturer for that part.

4.7 Manufacturer shall maintain proper account of LEDs being used. The record shall include various details like source of supply, procurement invoice number & date, quantity, incoming rejection, lot wise consumption etc. which may be verified by the inspecting officials.

4.8 LEDs used in display units of clocks shall be of high quality, procured from reputed manufacturers as mentioned in Clause 4.2. The maximum junction temperature of a LED shall not be less than 100°C and epoxy used in the LED shall have UV inhibitors.

4.9 Number of LEDs and their part number shall not be changed without prior approval of RDSO.

5. SPECIFICATION OF DIGITAL CLOCK SUITABLE FOR PLATFORM AREA:

5.1 Digital clock should be micro-processor/micro-controller based system. The micro-controller/micro-processor should be of reputed make.

5.2 Digital clock should have built-in GPS receiver in stand-alone mode with minimum specifications as specified in Clause 7 of this document. A Gold plated SMA connector shall be provided to connect GPS antenna.

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- 5.3 The system should have a built-in RTC (Real Time Clock) using a self-contained module having following minimum specifications:
- a) It should be microprocessor bus oriented.
 - b) Self contained sub system should include Lithium, Quartz & support circuitry.
 - c) It should be non volatile with over 8 years of retention of data in absence of power.
 - d) The accuracy should be in order of plus or minus ONE minute per month.
- 5.4 The system shall continuously display time maintained by the local RTC. This RTC shall be adjusted at least once in one minute to the time received from the GPS receiver. In case no GPS data is available, the clock shall display the local RTC time.
- 5.5 Communication status with GPS receiver shall be indicated with a blinking LED.
- 5.6 System should operate satisfactorily between operating temperature of -10° C to 70°C.
- 5.7 System should work satisfactory on 160 Volts — 270 Volts, 50 Hz, single phase power supply with under voltage and over voltage cut off protection. Short circuit protection should be provided for the power supply.
- 5.8 Complete system shall be housed inside enclosure made of Cold Rolled Closed Annealed (CRCA) Sheet of minimum 1.2 mm thickness. It should be powder coated in black colour to protect from rust.
- 5.9 Suitable arrangement shall be made for installing & hanging the digital clock as per site requirement and as specified by purchaser.
- 5.10 The system shall be made up of three distinct modules consisting of micro- processor/micro-controller module with GPS receiver when designed for stand alone mode, SMPS Power supply module and Display modules. The various modules shall be interconnected appropriately, such that replacement of any module shall not call for any de-soldering. Number of interconnecting wires shall be kept a minimum.
- 5.11 A test switch to check the display should be provided on one side of clock. When this switch is pressed the clock should display 88:88.
- 5.12 To protect the digital clock, a shade having angle of preferably 15° downward with respect to ground should be provided in such a way that it should not obstruct the view of clock.
- 5.13 Time shall be shown in Hours, Minutes separated by flashing colon indicating seconds. The time format shall be either 24 hour or 12 hour format with help of selection.
- 5.14 Digital clock suitable for platform area should work in stand alone mode only and each clock must be provided with GPS receiver.

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- 5.15 Digital clock shall be as per schematic illustrated in diagram 1 and shall comply following specification:

Features	Description
Display type	Seven segment LED matrix
No. of sides	Single or Double sided (As specified by purchaser)
Size of LED display modules	As per details given in Diagram 1.
Specification of LED	As per Clause 4.2
Pitch of LED	7.5mm \pm 10%
Number of Lines of LEDs in each segment of seven segment LED matrix	3 lines
Size of Seven Segment LED Matrix	315 mm (H) X 150 mm (W) \pm 1%
LED color	White/Amber
Format	24 Hrs. or 12 Hrs. Format (88: 88)
Seconds display	Flashing colon with two dots of nine LEDs in a circular shape between HH and MM
Overall maximum housing dimensions	510 mm (H) X 1200 mm (L) X 250 mm (D) for single sided and 510 mm (H) X 1200 mm (L) X 300 mm (D) for double sided
Working Power Supply range	160V to 270V AC, 50 Hz.
Operating Temperature	-10 ⁰ to 70 ⁰ C
Humidity	0% - 95% - non condensing
Enclosure Material	Cold Rolled Closed Annealed (CRCA) Sheet structure of minimum 1.2 mm thickness with display areas covered with UVstabilized Polycarbonate sheet of minimum 3mm \pm 0.3mm thickness.

6. SPECIFICATION OF DIGITAL CLOCK SUITABLE FOR OFFICE COMPLEX:

- 6.1 Digital clocks suitable for office complex are to be provided mainly in control offices, station master offices, RRI cabin etc. or as specified by purchaser.
- 6.2 Digital clock suitable for office complex shall comply clauses 5.1 to 5.9.
- 6.3 The system can be made up of three modules as micro-processor/micro-controller module with GPS receiver when designed for stand alone mode, SMPS power supply module and display modules. The micro-processor/micro-controller module and display module can be combined as single module to optimize the clock size. The various modules shall be interconnected appropriately, such that replacement of any module shall not call for any desoldering. Number of interconnecting wires shall be kept a minimum.
- 6.4 Time shall be shown in Hours, Minutes and seconds separated by flashing colon. The time format shall be either 24 hour or 12 hour format with help of selection.
- 6.5 A test switch to check the display should be provided on one side of clock. When this switch is pressed the clock should display 88:88:88.

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- 6.6 Digital clock display shall be LED type made of seven segment display matrix. Matrix should be made of six corner LEDs and seven segments in which each segment should be made of LEDs in double line with 6.0 mm \pm 10% pitch. All six corner LEDs and seven segments should be individually controlled. Each digit size shall be 78 mm \pm 2.0 mm in height & 42 mm \pm 2.0 mm in width.
- 6.7 Digital clock suitable for office complex should work in standalone mode only and each clock must be provided with GPS receiver.
- 6.8 Digital clock shall be as per schematic illustrated in diagram 2 and shall comply following specification:

Features	Description
Display type	Seven segment Display Matrix
No. of sides	Single sided
Size of LED display modules	As per details given in Diagram 2.
Specification of LED	As per Clause 4.2
Pitch of LED	6 mm \pm 10%
Number of Lines of LEDs in each segment of seven segment LED matrix	2 lines
Size of Seven Segment LED Matrix	78 mm (H) X 42 mm (W) \pm 2 mm
LED color	White/Amber
Format	24 Hrs. or 12 Hrs. Format (88 : 88 : 88)
Seconds display	Flashing colon with two dots of four LEDs in a square shape between HH , MM and SS.
Overall maximum housing dimensions	150 mm (H) X 420 mm (L) X 100 mm (D)
Working Power Supply range	160V to 270V AC, 50 Hz.
Operating Temperature	-10 ⁰ to 70 ⁰ C
Humidity	0% - 95% - non condensing
Enclosure Material	Cold Rolled Closed Annealed (CRCA) Sheet structure of minimum 1.2 mm thickness with display areas covered with UVstabilized Polycarbonate sheet of minimum 3mm \pm 0.3mm thickness.

7. SPECIFICATION OF GPS RECEIVER:

7.1 GPS Receiver should have following minimum specification:

7.1.1 L1 frequency, C/A code, 22- channel (minimum) continuous tracking receiver.

7.1.2 1Hz update rate.

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- 7.1.3 It should support NMEA protocols on serial port with configurable baud rate(TTL level)
- 7.1.4 Fully Compatible with SPS and accuracy should be better than 1ms.
- 7.1.5 Reacquisition time better than 1 sec (90%).
- 7.1.6 Hot Start better than 5 sec (90%).
- 7.1.7 Warm Start better than 10 sec (90%).
- 7.1.8 Cold Start better than 15 sec (90%).
- 7.1.9 Antenna short circuit protection.
- 7.1.10 Operating temperature -40°C to +85°C
- 7.2 GPS Antenna: It shall be provided with either magnetic mounting or screw (fixed) mounting with micro-patch, active antenna powered from the receiver module itself as per site requirement.
- 7.3 Sensitivity:
- (i) Acquisition -148 dBm
 - (ii) Tracking -165 dBm
 - (iii) Reacquisition -160 dBm

8. POWER SUPPLY:

- 8.1 Power supply unit shall be operated from AC source ranging from 160 to 270 Volts 50 Hz AC, single phase with over voltage, under voltage and short circuit protection.
- 8.2 All the power supply units shall be operated at 70% load of maximum working capacity.
- 8.3 Power supply requirement for digital clocks shall be as low as possible.
- 8.4 PVC insulated flexible 3 core power cables shall be used for power supply wiring wherever required conforming to specification no. IS:694:1990 reaffirmed 1995 or latest and shall have sufficient cross sectional area of 2.5 sq mm (minimum) copper conductor with insulation thickness 0.7mm, sheath thickness of 1.0 mm and overall diameter 9 mm to withstand power load.
- 8.5 Suitable protection against transient coming in the power supply source or generated by some other source shall be provided. Suitable protection against voltage fluctuations of short durations shall also be provided.
- 8.6 Power Supply cable shall be taken through pipes/conduits as per site requirement.

9. TESTS AND REQUIREMENTS:

9.1 Conditions of Tests:

- 9.1.1 Unless otherwise specified, all tests shall be carried out at ambient atmospheric conditions.
- 9.1.2 For inspection of material, relevant clauses of IRS: S 23 and RDSO/SPN/144 shall apply.

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9.1.3 Inspection and testing shall be carried out to the effect that all requirements of this specification are complied with.

9.1.4 Inspection shall be carried out for digital clocks suitable for platform area & office complex. GPS Receiver shall be checked during inspection for their functional performance required for proper working of complete system as per specification.

9.2 Type Tests:

9.2.1 For type test, one complete system consisting of all type of clocks shall be subjected to following tests as applicable:

- (a) Visual inspection (Clause 10.1)
- (b) Insulation Resistance Test (Clause 10.2)
- (c) Applied High Voltage Test (Clause 10.3)
- (d) Environmental/ Climate Tests (Clause 10.4)
- (e) Performance Test (Clause 10.5)
- (f) Endurance test (Clause 10.6.1)
- (g) Card-level functional tests on all the cards.
- (h) System level functional tests.
- (i) LED parameter tests (Clause 10.7)

9.2.2 One double sided digital clock suitable for platform area, one digital clock suitable for office complex shall be type tested for this purpose. All the system shall successfully pass all the type tests for proving conformity with this specification. If any one of the equipment fails in any of the type tests, the inspecting authority or his nominee at his discretion, may call for another equipment/ card(s) of the same type and subject it to all tests or the test(s) in which failure occurred. No failure shall be permitted in the repeat test(s). After successful completion type tests, these items are to be submitted to RDSO.

9.2.3 Separate enclosure of digital clock for platform area is to be fabricated suitable for keeping inside the environmental chamber for carrying out endurance and environmental/climatic tests. This clock shall be double sided with HOUR display modules along with flashing colon for SECOND on one side and MINUTE display modules on other side using same electronics of digital clock suitable for platform area. Display modules and electronics of this clock shall be placed in the double sided Platform Clock for carrying out other tests and to be submitted to RDSO.

9.2.4 Any other tests shall be carried out as considered necessary by the inspecting authority.

9.3 Acceptance Tests:

9.3.1 The following shall constitute the acceptance tests which shall be carried out by the inspecting authority for the purpose of acceptance on 20% of the lots (minimum 2 each type of system) offered for inspection by the supplier:

- i) Visual inspection (Clause 10.1)
- ii) Insulation Resistance Test (Clause 10.2)
- iii) Performance Test (Clause 10.5)
- iv) System level functional tests.
- v) Endurance Test (Clause 10.6.2)
- vi) LED parameter test (Clause 10.7)

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9.3.2 Any other tests shall be carried out as considered necessary by the inspecting authority.

9.4 Routine Tests:

9.4.1 The following shall comprise the routine tests and shall be conducted by manufacturer on every equipment and the test results will be submitted to the inspection authority before inspection.

- i) Visual inspection (Clause 10.1)
- ii) Insulation Resistance Tests (Clause 10.2)
- iii) Performance test (Clause 10.5)
- iv) Card-level functional tests on all the cards.
- v) System level functional tests.
- vi) Performance Test (Clause 10.5)
- vii) LED parameter test (Clause 10.7)

9.4.2 Any other tests shall be carried out as considered necessary by the inspecting authority.

10. TEST PROCEDURE:

The test procedure shall be based on the system design. The methodologies to be adopted for various tests shall be decided taking into account the system design/configuration.

10.1 **Visual Inspection:** Each equipment of the system shall be visually inspected to ensure compliance with the requirement of clause 2 to 8 of this specification. The visual inspection shall broadly include:

10.1.1 System Level Checking:

- i) Constructional details.
- ii) Dimensional check.
- iii) General workmanship.
- iv) Configuration.
- v) Mechanical polarization of cards.

10.1.2 Card Level Checking:

- i) General track layout.
- ii) Quality of soldering and component mounting.
- iii) Conformal Coating.
- iv) Legend printing.
- v) Green or Black masking.

10.1.3 Module Level Checking:

- i) Indications and displays.
- ii) Mounting and clamping of connectors.
- iii) Proper housing of cards.

10.2 Insulation Resistance Test: This test shall be carried out:

- (a) Before the high voltage test
- (b) After the high voltage test

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(c) After completion of the climatic test

The values shall not be less than 10 Mega ohms. The measurement shall be made at a potential of 500V DC.

10.3 Applied High Voltage Test: The equipment shall withstand for one minute without puncture and arcing, a test voltage applied between line terminal and earth as mentioned below:

(a) AC line terminals and earth, test voltage of 1500V AC

(b) DC line terminals and earth, test voltage of 500V AC

The test voltage shall be alternating of approximately sinusoidal waveform of any frequency between 50 Hz and 100 Hz. Printed circuit cards shall be removed during the test.

10.4 Environmental/ Climate Tests:

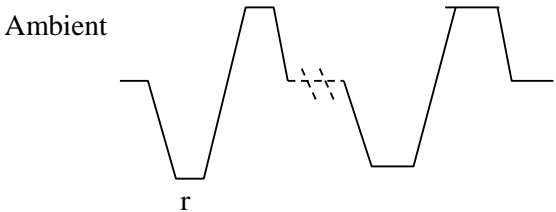
10.4.1 The digital clocks shall be capable of working in non-air conditioned environment in the field.

10.4.2 The clocks shall be suitable for installation on AC/ DC electrified and non-electrified sections. It shall be suitable in all areas including where locomotives having thyristor controlled single phase or 3-phase induction motors haul passenger or freight trains and where chopper controlled EMU stocks are operated.

10.4.3 The digital clocks shall meet the following climatic and environmental requirements:

SN	TEST		REFERENCE
1.	Change of temp test		IS 9000 Part XIV Sect. II
	Low temp	$-10^{\circ}\text{C} \pm 3^{\circ}\text{C}$	
	High temp	$+70^{\circ}\text{C} \pm 2^{\circ}\text{C}$	
	Rate of change in temperature	$1^{\circ}\text{C} / \text{min}$	
	Duration	7hrs at each temp. -10°C & $+70^{\circ}\text{C}$	
	Cycle	3	
	Condition	Fully functional during test	
2.	Dry heat test		IEC-571; IS:9000 Part-III Sect 3
	Temp	$+70^{\circ}\text{C} \pm 2^{\circ}\text{C}$	
	Duration	16 hrs	
	Condition	Fully functional during test	
3.	Cold test		IS 9000 Part II Sect. III
	Temp	$-10^{\circ}\text{C} \pm 3^{\circ}\text{C}$	
	Duration	2 hours	
	Condition	Fully functional during test.	

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4.	Damp heat test (Cyclic)			IS 9000 Part V Sect. 2 Variant 1
	Upper temp	40° C ± 2 ° C		
	Humidity	95% (+1%, -5%)		
	Cycles	6		
	Condition	Fully functional during one hour period towards end of each cycle. Stabilization shall be done at 25° ± 3 ° C		
5.	Damp heat test (Steady state storage)			IS 9000 Part IV
	Temp	40° ± 2 ° C		
	Humidity	93% (+2%, -3%)		
	Severity	4 days		
	Condition	Fully functional during test.		
6.	Salt mist test			IS 9000 Part XI procedure 3
	Mist + Damp heat	Procedure 3: 2 hours + 22 hours		
	Temp	35° ± 3 ° C		
	Humidity	93% (+2%, -3%)		
	Hours	22		
	Cycle	3		
	Condition	After this test, electrical parameters shall be monitored in addition to physical checks.		
7.	Dust test			IS 9000 Part XII
	Duration	1hour		
	Condition	After this test, electrical parameters shall be monitored in addition to physicalchecks.		
8.	Bump test			IS 9000 Part VII, Sec. 2
	PCBs/Modules/units in packed condition shall be subjected to bump test as under:			
	No of bumps	1000		
	Peak acceleration	400 m/s ²		
	Pulse duration	6 ms		
	No of axes	3		
	Condition	After this test, electrical parameters shall be monitored in addition to physicalchecks.		
9.	Vibration test			QM-333
		Up to & including 75 Kgs. weight	Over 75 Kgs.	
	Freq. Range	05-350 Hz	5-150 Hz	

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	Amplitude	± 6 mm constant displacement or 15m/Sec. ² constant acceleration.	± 6 mm constant displacement or 15m/Sec. ² constant acceleration.
	No. of axes	3	3
	No of sweep cycle	20	10
	Total duration	105 min/axis	105 min/axis
	If resonance is observed	10 min at each resonant freq.	10 min at each resonant freq.
	Condition	After this test, electrical parameters shall be monitored in addition to physical checks.	
10.	Environmental Stress Screening tests (ESS) for Printed Circuit Boards (PCB) & sub systems: (The manufacturer shall carry out the following ESS tests on all modules on 100% basis during production / testing in the sequence as follows. Suitable records shall be maintained regarding the compliance of these tests.)		
10.1	Thermal cycling: The PCBs shall be subjected to thermal cycling as per the procedure given below. The assembled boards are to be subjected to rapid temperature cycling as mentioned below in the power off condition.		
	❖ This temperature cycling from 0° C to 70° C, ½ Hours at each temperature for 9 cycles and 1 hour at each temp. for the 10 th cycle. Dwell time of 1 hour is provided for the last cycle in order to oxidize defective solder joints exposed through thermal stress.		
	<p style="text-align: center;">70° C, ½ Hour 1 Hour</p>  <p style="text-align: center;">r</p> <p style="text-align: center;">0° C, ½ Hour</p> <p>❖ The rate of rise / fall of temp. shall be minimum 10° C per minute.</p> <p>❖ In addition to physical checks, the electrical parameters are also to be monitored after this test.</p>		
10.2	Power cycling: The power supply modules shall be subjected to 60 ON-OFF cycles for 1 hour. The ON-OFF switch usually provided in the modules may not be used for this purpose.		

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10.4.4 Driving Rain Test: Driving rain test is also to be conducted on Platform GPS clock only as per following procedure.

Test		Reference
Driving Rain Test		IS 9000 Part XVI Test condition ‘c’
Water spray for 1 hour		
Condition	After this test, electrical parameters shall be monitored in addition to physical checks.	

10.5 Performance Test: The equipment shall comply with the requirements as specified in Clauses 2 to 8.

10.6 Endurance Test:

10.6.1 During type test, endurance test shall be conducted on system mentioned in Clause 9.2.2 for continuous operation which shall be 168 hours at 60⁰C burning for LED without giving any deterioration in light output.

10.6.2 During acceptance test, endurance test shall be conducted on samples as per Clause 9.3.1 for continuous operation which shall be 48 hours at room temperature burning for LED without giving any deterioration in light output.

10.7 LED Parameter Test:

10.7.1 The parameters of LED are to be tested as specified in Clause 4.2 for all the tests as mentioned below.

- i) For type test, 10 nos. of LED shall be tested from the lots used in manufacturing digital clocks.
- ii) For acceptance test, 8 nos. LED shall be tested from the lots used for making digital clock suitable for platform area and digital clocks suitable for office complex.
- iii) For routine test, one LED from a batch of 5000 LEDs shall be tested. If it fails, then total batch of LEDs shall be tested, of which if more than 1% of LEDs fails, then entire batch of LEDs shall be rejected.

10.7.2 The manufacturer shall submit the LED data sheets at the time of inspection.

11. QUALITY ASSURANCE:

11.1 All materials & workmanship shall be of good quality.

11.2 Since the quality of the equipment bears a direct relationship to the manufacturing process and the environment under which it is manufactured, the manufacturer shall ensure Quality Assurance Program of adequate standard.

11.3 Validation and system of monitoring of QA procedure shall form a part of type approval. The necessary plants, machineries and testing equipments required for production & quality assurance as per Scheduling of Technical Requirements (STR) shall be available with the manufacturer.

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12. MARKING & PACKING:

12.1 The following information shall be clearly marked at a suitable place on each equipment:

- i) Name and Address of the manufacturer.
- ii) Month & Year of the manufacturing.
- iii) Serial number of Equipment.
- iv) Specification number.
- v) Schematic diagram of the equipment on the side of the cover.

12.2 The equipment and its sub assemblies shall be packed in thermocole boxes and the empty spaces shall be filled with suitable filling material. Before keeping in the thermocole box, the equipment shall be wrapped with bubble sheet. The equipment shall be finally packed in a wooden case of sufficient strength so that it can withstand bumps and jerks encountered in a road/rail journey.

13. INFORMATION TO BE SUPPLIED BY THE MANUFACTURER:

13.1 The following documents in two sets should be supplied along with the system:

- i) Mechanical drawings of each sub system/ rack.
- ii) Installation and maintenance manual incorporating trouble shooting exercises, printed cards patterns, software etc.
- iii) Operating and trouble shooting manual.
- iv) Pre-commissioning check list.

14. INFORMATION TO BE SUPPLIED BY THE PURCHASER:

14.1 The purchaser should clearly indicate details of required items which shall mainly consist of following items as per requirement.

S.No	Description of the Item	Quantity
1.a	Double sided Digital Clock suitable for platform area	As per site requirement
1.b	Single Sided Digital Clock suitable for platform area	As per site requirement
2	Digital Clock suitable for Office Complex	As per site requirement
3	Color of LEDs: White or Amber, unless specified default is White Color	As specified by the purchaser
4	Power Cable and extension boards	As per requirement
5	Any other items or features required by the purchaser	As per requirement

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15. TRAINING:

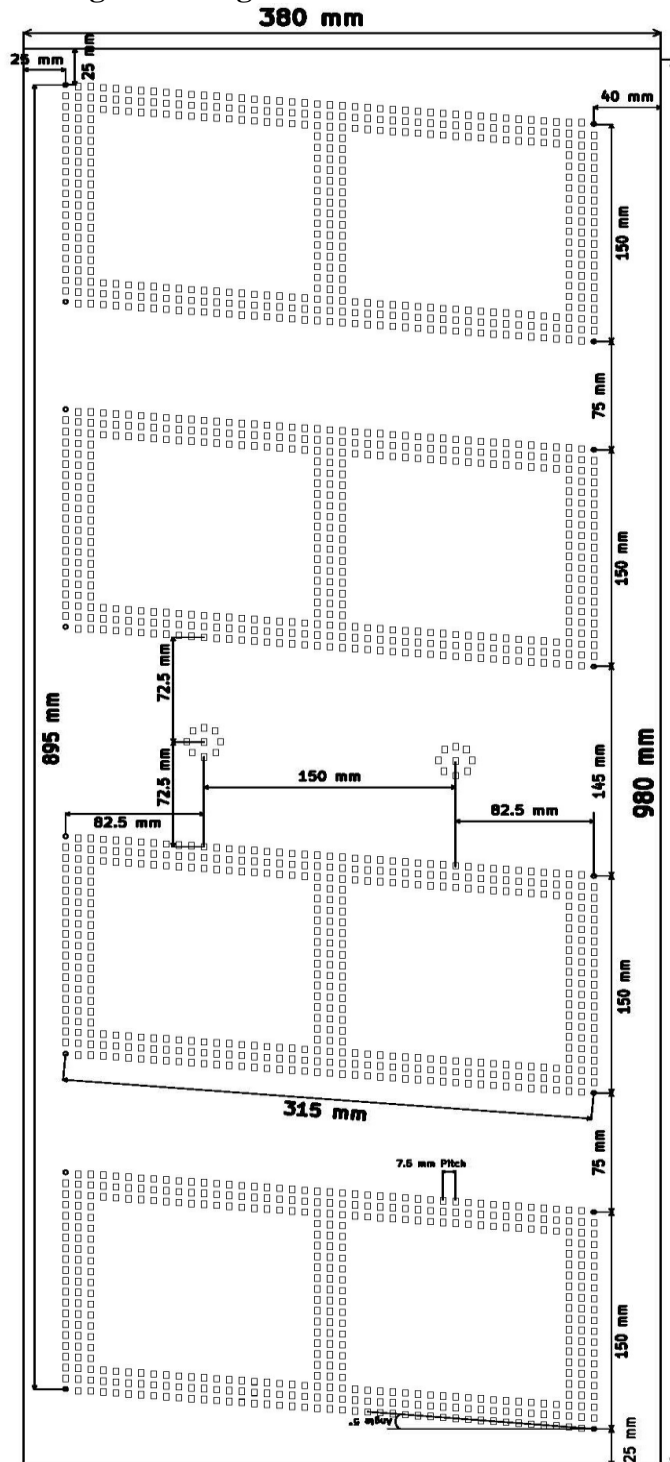
- 15.1 On site training shall be provided to the Railway staff which shall include complete assembly of the system through the use of various modules, integration of hardware with software and complete operation of the system.

16. DIAGRAMS:

Detailed construction diagrams of Digital Clock suitable for platform area (single sided and double sided) and Digital Clock suitable for office complex are to be approved by RDSO before starting manufacturing.

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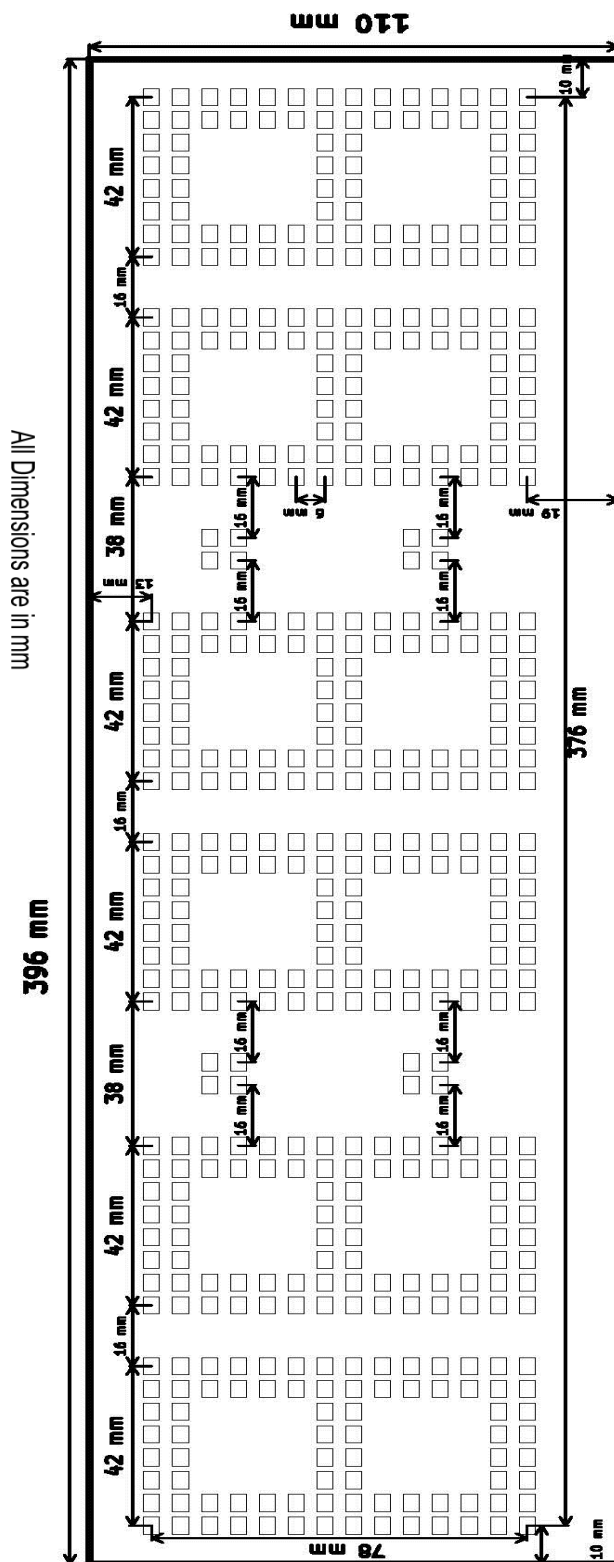
17. Schematic Diagram of Digital Clock suitable for Platform Area:



(Tolerance in Dimensions ± 5 mm)
Diagram – 1 (All dimensions in mm)

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18. Schematic Diagram of Digital Clock suitable for Office Complex:



(Tolerance in Dimensions ± 5 mm)

Diagram – 2 (All dimensions in mm)

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- 19.** "All the provisions contained in RDSO's ISO procedures laid down in Document No. QO-D-8.1-11 Version No.: 2.7 dated 05.02.2024 (titled "Vendor-Changes in approved status") and subsequent versions amendments thereof, shall be binding and applicable on the successful vendor/vendors in the contracts floated by Railways to maintain quality of products supplied to Railways".
