

4	PANEL MOUNTED AND MISCELLANEOUS INSTRUMENTS	2
4.1	GENERAL	2
4.1.1	Scope	2
4.1.2	Reference Standards	2
4.1.3	Submittals	2
4.1.4	Quality Standards	3
4.1.5	Manufacturers Test Certificates	3
4.1.6	Approved Manufacturers	3
4.2	PRODUCTS	3
4.2.1	Digital Indicators and Totalizers	3
4.2.2	Trip Amplifiers	4
4.2.3	Relays-Electromagnetic Type	4
4.2.4	Timers	4
4.2.5	Running Time Meters	5
4.2.6	Programmable Logic Controllers (PLC's)	5
4.2.7	Alarm Annunciators	5
4.2.8	Chart Recorders	6
4.3	INSTALLATION	6
4.3.1	General	6

4 PANEL MOUNTED AND MISCELLANEOUS INSTRUMENTS

4.1 GENERAL

4.1.1 Scope

- 1 This Part specifies the panel mounted and miscellaneous instruments and equipment to perform the required functions in conjunction with information and equipment specified in other Parts of Section 10.
- 2 Unit Responsibility. It shall be the responsibility of the ICA Sub-Contractor as described in Part 1 of this Section to ensure that the panel instruments and equipment supplied under this Part are compatible with the primary elements and telemetry/SCADA equipment and equipment specified under other Sections of these specifications, and that the signal transmission methods are compatible.
- 3 Enclosures of front of panel mounted instruments shall be of uniform design and colour scheme wherever possible. Front of enclosure colours shall be compatible with panel colours and subject to final approval by the Engineer. Normally, compatible standard colours of the manufacturer shall be acceptable.
- 4 Related Sections and Parts
This Section
Part 1, General.

4.1.2 Reference Standards

- 1 The following standards are referred to in this Part:
BS 5515Code of Practice for Documentation of computer based systems
BS 7165Recommendation for achievement of quality in software
EN 50081Electromagnetic Compatibility
EN 61131-3P.....Programming Languages for Programmable Controllers.
IEEE 472-1974.....Surge protection
ISO 3511Process measurement control functions - instrumentation symbolic representation
ISO 9075 (BS 6964)...Structured Query Language (SQL)
National Electric Code (NEC) 110.14 Electrical Connections and panel spacing
Instrument Earthing shall comply with the IEC 60079 ensuring being less than 1 ohm.
Terminal block segregation shall be for each I/O type as well

4.1.3 Submittals

- 1 Submittals shall be in accordance with Part 1 of this Section.
- 2 The following shall be included in the submittals:
 - (a) shop drawings, product data, and samples
 - (b) complete description, specifications, drawings, and descriptive literature on the equipment.

- (c) make and model of each component
 - (d) number of sizing electrical and control wires and power requirements
 - (e) complete wiring and equipment instrumentation diagram
 - (f) list of spare Parts to be provided
 - (g) recommended procedure for protection of equipment against damage prior to installation
 - (h) complete system diagram showing required components, routing through in-plant duct bank system.
- 3 The submittals shall be subject to approval by the Engineer. The Contractor shall submit the final documentation based on the Engineer's comments. The Engineer's comments/approval shall be issued to the Contractor within 21 calendar days of the submittal.

4.1.4 Quality Standards

- 1 Manufacturer: In addition to requirements of Part 1, Instrumentation and Control equipment furnished shall be manufactured by a Company regularly and currently engaged in the design and manufacture of similar equipment. All equipment furnished shall be new and of the most recent design.
- 2 Maintainability: All equipment shall be designed for ease of maintenance and repair, and access to critical Parts shall not require major dismantling. Internal field adjustments where permitted or required herein shall be easily accessible upon removal of a panel or cover.
- 3 Materials and installation shall comply with the requirements of the current editions of referenced electrical codes and standards, and the codes and standards referred to shall be used for establishing the minimum quality of the materials and equipment supplied and installed. All equipment of the same type shall be products of the same manufacturer.

4.1.5 Manufacturers Test Certificates

- 1 Manufacturers shall test and calibrate each input/output to operate within specified limits. Calibration and compliance certificates provided by the manufacturer, shall be authenticated by the Contractor and submitted to the Employer.

4.1.6 Approved Manufacturers

- 1 All ICA equipment shall be provided by approved, prequalified manufacturers and suppliers designated in the Project Specification.

4.2 PRODUCTS

4.2.1 Digital Indicators and Totalizers

- 1 Digital indicators shall be panel mounted type. 96 mm (w) by 48 mm (H) dimensions. 110/240 V a.c. 50 Hz power supply. 4 1/2 digit LED or backlit LCD display for process variable. Range shall be programmable in Engineering units. Input shall be 4-20 mA d.c. or volt free contact as specified in the Project Specification. Loop power for 2-wire transmitter shall be provided as required. At least two programmable alarm contacts for high or low alarms. Totalizers shall have 8 digit display with manual reset facility.

4.2.2 Trip Amplifiers

- 1 Trip Amplifiers shall be surface or rack mounted with 240V a.c. 50 Hz power supply. Input shall be 4-20 mA d.c. 1 or 2 independent adjustable set points shall be provided as specified in the Project Specification. Outputs shall be SPDT relay contacts rated 240 V a.c. 5A.

4.2.3 Relays-Electromagnetic Type

- 1 Relays shall be provided as necessary to perform switching functions required of control panels and other control circuits.
- 2 Control Relays. Control relays shall be provided for the control and alarm circuits as indicated in the Project Specifications. The relays shall be electrically held, 50 Hz, continuous duty, multiple connected to 240 V a.c. control circuits and mounted inside control panels or separate metal enclosures as indicated. Enclosures shall be IP66. The relay base assembly shall accept from 1 through 8 convertible poles. Relays shall be attached to pre-shaped mounting channels with captive screws.

4.2.4 Timers

- 1 Timers shall be provided as specified herein or indicated in the Project Specifications. Timers shall have four types of operation: (1) On Delay (2) Off-Delay (3) Single Shot, and (4) Duty Cycle timers. Time ranges shall be as shown in the Project Specification.
- 2 Panel mounted timers shall be of the motor driven adjustable type with dials and presentable pointers. The timers shall operate from 240 V, single-phase, 50 Hz power and shall be of the square bezel type for flush panel mounting. Output contacts shall be double throw and rated for 10 A at 240 V a.c.. The number of contact sets shall be sufficient to perform the required control functions. Where more contacts are required than supplied as commercial standards, control relays of equal rating shall be used to supplement the timer contacts. When specified, relay contacts shall be supplied as Part of the timer and shall be operated by the timer control power independently of the timed contacts. Repeatability of the preset time delays shall be within $\pm 2\%$. Timers shall be of the plug-in type and enclosed in dust-proof cases. Connection shall be by numbered screw terminals in the rear of the timer connector.
- 3 On delay timers. When a start signal is applied, the timing cycle begins. Output contacts change state after the time delay is completed. Contacts shall return to original state when a reset signal is applied or power is removed.
- 4 Off delay timers. When a start signal is applied, the output contacts change state immediately. When the start signal is removed, the timing cycle begins and the output contacts return to the original state when the cycle is completed. Timer shall be reset by a reset signal or by removal of power.
- 5 One shot timers. When a start signal is applied, the output contacts change state immediately and the timing cycle begins. The output contacts return to the original state when the cycle is completed. Timer shall be reset by a reset signal or by removal of power.
- 6 Duty Cycle timers. Two timer cycles shall be incorporated. When a start signal is applied, the first timing cycle begins. The output Contacts change state at the end of the cycle and the next timing cycle begins. When this delay is completed the output contacts return to the original state. This sequence is repeated until a reset signal is applied or power is removed.

4.2.5 Running Time Meters

- 1 Running time meters shall be of the synchronous motor driven type having a minimum of six (6) decimal digits where the least significant digit shall represent tenths (1/10's) of hours. Unless specified otherwise in the Project Specification, they shall not be equipped with a reset button. They shall be for panel mounting with a square bezel approximately 60 mm on a side. Motor voltage shall be 240 V a.c.

4.2.6 Programmable Logic Controllers (PLC's)

- 1 See Section 10, Part 2, Telemetry/SCADA for PLC specifications.
- 2 PLC's shall be installed inside Local Control Panels or in separate cubicles, as specified in the Project Specification.
- 3 Software development and system configuration shall be the Contractor's and the ICA Subcontractor's responsibility. The Software developed by using the P&IDs and I/O point list shall be submitted to the Engineer for approval prior to installation in the operating system

4.2.7 Alarm Annunciators

- 1 All windows in the alarm and status annunciator shall be nominally 36 mm by 76 mm, of white plastic, and rear lighted with two low voltage, heavy filament lamps. The plastic windows shall be engraved with black letters in accordance with the Drawings. The windows shall be removable from the front for lamp replacement. The lamp units and electronic drivers shall be in one case, unless otherwise approved in writing, with a removable cover and designed for panel mounting. The lamps shall be mounted such that replacement is possible from the front of the annunciator panel without tools. Lamp sockets and mountings shall be robustly constructed, so as not to be loosened or misaligned when lamps are replaced. The windows shall be in rows of six, unless otherwise shown. The monitoring modules shall be of all solid state plug-in design. There shall be sufficient electronic modules to drive all required annunciator windows, including spares. When specified, provide repeater contacts terminated on a terminal strip for externally monitoring each alarm status. The annunciator power supply shall be sufficient to drive all required loads. Alarm points shall be driven by modules with the operating sequence shown below. The windows for status indication, when specified shall be off and steady on only, colour shall be white or as shown in Table 4.1:

Table 4.1
Alarm Module Operational Sequence

Condition	Display	Audible
Normal	Off	Off
Alert	Flash	On
Acknowledge	Steady On	Off
Return to Normal after Acknowledge	Off	Off
Return to Normal before Acknowledge	Flash	On

- 2 The alarm and status actuators shall be contacts or as shown on the Drawings. The annunciator shall accept either Normally Open (N.O.) or Normally closed (N.C) contacts. The sensing voltage shall not exceed 24 V d.c. The units shall be supplied with audible-flasher cards as required that shall operate on receipt of alarms from any of the alarm points to the panel. A buzzer shall be provided and mounted in the control panel. A horn in a weather proof housing shall be provided for external mounting when specified. On receipt of any alarm the monitor card shall cause the flasher to flash the appropriate indicating window and sound the alarm.
- 3 There shall be a test button and an acknowledge button. The test button shall actuate all alarm and status points and sound the audible alarm. The acknowledge button shall perform the functions as outlined in the operational sequence, but shall not prevent any future alarm points from being annunciated visually and audibly. The unit shall operate from 110/240 V a.c., 50 Hz commercial power.
- 4 When specified, a "first out" sequence shall be provided in which the first alarm in a related group, as designated, shall flash red while subsequent alarms in the group shall be non-flashing white. A first out reset button shall be provided for each designated group.

4.2.8 Chart Recorders

- 1 Paperless video graphic recorders with colour LCD display and internal and external storage, networking capability shall be provided having the following specification:
 - (a) screen size 127mm (minimum) front panel to IEC 529 – IP65 standard and cut out size 138mm x 138mm
 - (b) required number of input channels but never less than two and capable of 4-20mA, mV, V, RTD, thermocouple inputs
 - (c) minimum scan rate of 125ms and chart speed of 1mm/hour to 1200mm/hour
 - (d) totaliser with mathematical functions
 - (e) RS232 serial Ethernet 10 Base T interfaces
 - (f) data storage facilities with a minimum of 1MB internal flash
 - (g) integral smart media with 128MB smart card and media door lock
 - (h) capability of being configured by both PC keyboard and via tactile membrane front door key.

4.3 INSTALLATION

4.3.1 General

- 1 Installation, testing, calibration, validation, start-up, and instructions shall be in accordance with Part 1 of this Section.

END OF PART