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KLM Technology Group #03-12 Block Aronia, Jalan Sri Perkasa 2 Taman Tampoi Utama 81200 Johor Bahru Malaysia	LEVEL MONITORING (PROJECT STANDARDS AND SPECIFICATIONS)	

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SCOPE

This Project Standards and Specification is for the selection, engineering, design and establishing the criteria associated with Level Monitoring

REFERENCES

Throughout this Standard the following dated and undated standards/codes are referred to. These referenced documents shall, to the extent specified herein, form a part of this standard. For dated references, the edition cited applies. The applicability of changes in dated references that occur after the cited date shall be mutually agreed upon by the Company and the Vendor. For undated references, the latest edition of the referenced documents (including any supplements and amendments) applies.

1. AASHO (American Association for State Highway Officials)
2. ANSI (American National Standards Institute)
3. ASME (American Society of Mechanical Engineers)
4. ASTM (American Society of Testing Materials)
5. BS (British Standards)
6. IEC (International Electrotechnical Commission)
7. IEEE (Institute of Electrical and Electronic Engineers)
8. IES (Illuminating Engineering Society)
9. IPCEA (Insulated Power Cable Engineers Association)
10. ISA (Instrumentation, Systems and Automation Society)
11. ISO (International Organisation for Standardisation)
12. NEC (National Electrical Code)
13. NEMA (National Electrical Manufacturers Associates)
14. NFPA (U.S. National Fire Protection Association)
15. OSHA (Occupational Safety and Health Association)
16. SAMA (Scientific Apparatus Makers Association)
17. SANS (South African National Standards)
18. UL (Underwriters Laboratories)

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DEFINITIONS AND TERMINOLOGY

Analogue - The variable signal transmitted or received by transmitters or PLC components.

Control & Instrumentation – The discipline concerned with the engineering, design, procurement and implementation of instruments and associated equipment to control industrial processes and plant.

Client - The end user who will take final custody of the plant after formal hand-over.

Data Sheet - A C&I Document reflecting the condensed but exact requirements of a piece of equipment to perform a certain duty and:

- The Data Sheet shall include all information pertaining to the tag number(s), environmental conditions, type, size, materials of construction, ranges, engineering units, air/power requirements, mounting methods, displays,
- The Data Sheet may also invite/provide for Supplier's recommendations to assist the engineer in selections etc.
- The data sheet shall provide signature spaces for the C&I Engineer as well as the Discipline Engineer who provided process, civil, mechanical and piping data.
- Only the C&I Engineer and the co-responsible engineer from the other discipline(s) need to sign off and authorise the data sheet as formal.

Engineer - This shall at all times be the accountable C&I engineer liable for the technical selection, design, engineering, connection diagrams, hook-up drawings, loop diagrams, location drawings, bills of quantities, loop packages and Quality Assurance documents from procurement to C1-C5 commissioning. Any representative of the engineer shall be formally authorised so as to ensure central responsibility

Loop - The wiring configuration showing the field mounted instrument complete with its cabling, wires and connections from the field item through all intermediate terminal and junction boxes, marshalling terminals strips right up to the PLC I/O module. The drawing created for the loop is called the LOOP DIAGRAM and each loop diagram shall only reflect the components contained in the loop and all wiring, terminal and cable numbers shall be shown.

Programmable Logic Controller - comprising the modules such as a central processor, on-board power supply and input/output modules for the control of equipment.

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Remote - Shall mean controlling of a device from a CCR or other controller not installed in the immediate vicinity of the device.

Remote I/O - PLC Input/Output modules housed in field mounted cabinets away from the PLC/SCADA location.

RIO - A field mounted enclosure housing remote Input/output modules with their power supplies and signal converting units, terminals etc.

SCADA - A Supervisory Control and Data Acquisition system normally comprising the HMI, associated servers and UPS units for power independence.

Specification - A C&I Document which is deemed "Project Standard and Specification" reflecting the exact technical requirements of equipment required to perform a specific function in terms of its technical criteria:

- A Specification shall reflect all the environmental, climatic, individual plant and process conditions which the equipment will be subject to, the expectations of its performance and the tolerances within which the equipment is to perform.
- The Specification shall further reflect process criteria within which the equipment shall perform. There may be certain aspects not mentioned in the Specification being left for the Supplier's recommendations.
- The Specification shall reflect the crating, packaging, addressing and delivery instructions in both Enquiry and Procurement instances.
- The Specification shall reflect the required documentation to be submitted by the Tenderer or Supplier.
- The Specification shall reflect the calibration requirements associated with equipment.
- The Specification shall reflect the special tools if and when required.
- The narrative within a Specification shall then be condensed onto a Data Sheet.

Standard - A document reflecting the minimum criteria and technical standards the C&I engineer will use as his guideline for selection of the correct instrument for the correct application.

Supplier - The successful supplier of equipment & instruments culminating from enquiries, tenders and adjudication processes.

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SYMBOLS AND ABBREVIATIONS

<u>SYMBOL/ABBREVIATION</u>	<u>DESCRIPTION</u>
BCEW	Bare Copper Earth Wire
C&I	Control & Instrumentation
CCR	Central Control Room normally housing the PLC, SCADA and I/O cubicles.
HMI	Human Machine Interface such as PC keyboard & monitor combinations or panel mounted operator stations.
I/O	The Input/Output modules associated with PLC controllers.
PLC	Programmable Logic Controller
PVC	Polyvinyl Chloride plastic insulation used with electric cables.
TCP/IP	Transmission Control Protocol / Internet Protocol.
UPS	Uninterruptible Power Supply normally floor standing, battery backed-up.

COMMON TECHNICAL FEATURES

Level transmitters generally have common features such as power supply requirements and output signals. The following shall then be taken into consideration during selection and design:

- Power requirements shall mean the mains supply which shall be in accordance with the Project official voltages
- Signals to the PLC may be analogue (typically 4-20mA)
- The transmitter may be furnished with SMART transmission in which event the signals shall be led to the PLC via field bus systems
- Loop powered instruments, two and three wire configurations, shall be connected to the matching I/O modules
- Protection rating of instruments shall be minimum IP 65

LEVEL MONITORING & CONTROL

1. Level monitoring; shall cover all technical selections such as:
 - Ultrasonic
 - Radar
 - Differential pressure
 - Capacitance

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- Laser
 - Nuclear
 - Level switching
2. Level monitoring; shall include for Indication as well as Control via a variable external electrical signal typically 4-20mA or for Switching via a discreet electrical signal.
 3. Loop powered; equipment will not require external power supplies but where external power is required the voltages shall be to the Project Standards and Specification.

TECHNICAL REQUIREMENTS

Ultrasonic Level

Ultrasonic level technique is the using of sound waves above audible frequencies and since sound is affected by a number of aspects within confined spaces it has its limitations.

The following shall be considered in the selection and engineering phase of ultrasonic level monitoring:

1. Application

Ultrasonic equipment should not be used in vessels where dust, foam, turbulence and large solid lumps are present. The ideal conditions are in vessels containing stable liquid surfaces or small sized solids with a low angle of repose. Mild rippling may be compensated for by filtering out certain harmonics in the electronics of the transmitter.

2. Sizing & strength

Sizing and beam strengths are dictated to by vessel depths hence larger ranges require stronger beam strengths. The C&I Engineer shall obtain mechanical vessel drawings reflecting sizes and shapes to scale to assist in the selection.

3. Installation criteria

Ultrasonic level instruments are normally supplied with transducer and transmitter as separate (Remote) units. Installation considerations shall be:

- a. The transducer head must be mounted as close as possible to the side/rim of the vessel for ease of access. The transmitter must be installed as close to the transducer as possible within the interconnecting cable limitations.