Smith Meter® AccuLoad® IV

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The Smith Meter AccuLoad IV family of electronic preset delivery systems provides safe, reliable control and accurate measurement for custody transfer loading and unloading of petroleum liquid products. With several models to choose from, you can find one that is right for any application, whether it is part of a complex system involving automation, blending, and numerous load arms, or a small-scale bulk plant. The AccuLoad product line has been continuously refined for over 35 years to provide the ultimate in features and flexibility. The AccuLoad IV is tailored for current operations and adaptable to future growth and enhancements.

Applications

The AccuLoad's applications include batch loading of biofuels, gasoline, antifreeze, lube oils, fuel oils, solvents, liquefied petroleum gas (LPG), natural gas liquids (NGL), and chemicals. The system is ideal for truck, barge, or rail car loading at loading racks, bulk plants, shipping docks, processing installations, and tank farms where straight and blended products must be accurately loaded.

Models

Single Touch Screen (ST)

- Explosion-proof enclosure
- Two-arm operation
- Up to four single- or dual-pulse product meter inputs
- Up to four additive-meter inputs
- Up to 24 additive-meter inputs with A4I module
- AccuLoad III to IV Upgrade Kit (UG3)

Quad Touch Screen (QT)

- Explosion-proof enclosure
- Up to six-arm operation
- Up to six single- or dual-pulse product meter inputs
- Up to four additive-meter inputs
- Up to 24 additive-meter inputs with A4I module
- AccuLoad III to IV Upgrade Kit (UG3)

NEMA 4 (N4)

- NEMA 4X enclosure
- One- or two-arm operation
- Up to four single- or dual-pulse product meter inputs
- Up to four additive-meter inputs with local I/O
- Up to 24 additive-meter inputs with remote A4I module
- Stainless steel enclosure
- Integrated card reader, indicator lights, and stop button options

*Optional switch and lights not shown.

Split Architecture (SA)

- NEMA 4X enclosures
- Up to eighteen-arm operation
- Up to 24 single- or dual-pulse product meter inputs
- Up to 56 additive-meter inputs with A4I module
- Up to 96 additive-meter inputs with remote A4I module
- Integrated card reader, indicator lights, and stop button options on the man-machine interface (MMI)
- AccuLoad III to IV Upgrade Kit (FMU)
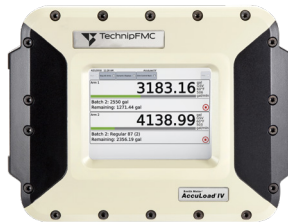
*Optional switch and lights not shown.

AccuLoad IV Features

- Individually configurable loading arm functions for:
  - Straight product delivery
  - Sequential blending
  - Ratio blending
  - Hybrid blending
  - Vapor recovery unit (VRU) operation
  - Unloading operation

- Up to six products for each load arm

- Simultaneous operation of all load arms

- User-configurable inputs and outputs

- Additive control for metered, smart, and piston injectors

- Digital or analog valve flow control

- Single- and dual-channel meter pulse inputs

- Fully configurable flow profile

- Alarm monitoring with configurable action

- Standalone operation or remote-controlled through-communication link

- Measurement profile:
  - Automatic temperature and pressure compensation and density correction
  - American Petroleum Institute (API) tables for light products to crude oils
  - Biofuel volumetric compensation
  - Meter factor linearization

- Extensive security:
  - Five levels of passcodes
  - Per-parameter access control
  - Audit log of parameter changes

- Onboard diagnostics:
  - Detailed operational status
  - Manual control of inputs/outputs
  - Event logging
  - Communication monitoring
  - Valve solenoid maintenance monitoring
  - Valve tuning assistance

- Ethernet and serial communications:
  - Modbus
  - Network printing
  - Proximity card reader
  - Driver access database
  - Promass interface
  - Configurable bill of lading (BOL)

- Browser-based remote access:
  - Control/monitoring of loading process
  - Diagnostic information
  - Virtual loading screen anywhere on the network

- Built-in virtual load rack (VLR) simulates loading rack equipment for diagnostics and training

- Boolean/algebraic processing

- Automatic flow control with recovery

- Linux operating system for networking

- Color liquid-crystal display (LCD) with touch screen user interface

AccuLoad IV SA

The AccuLoad IV Split Architecture system is a unique solution for multiple arm, multiple meter control and measurement systems used to control a lane of loading arms. The system is designed to mount in either a North American Class I Division 2 area, a Class I Zone 2 area, or a general purpose area. Up to 18 loading arms and 24 meters can be controlled and monitored by the system, which includes the MMI and flow-control module (FCM). The MMI provides the display and user interface for the SA system, while the FCM houses the control and I/O for the loading arms. These loading arms can be controlled either as blended or straight product arms. The system has the flexibility of handling multiple blending applications, straight ratio blending, side stream blending, and up to six-product sequential blending on the same loading lane. Using a single MMI, up to six arms can be loaded simultaneously; using two MMIs, up to twelve arms can be loaded simultaneously.

AccuLoad III to IV Upgrade Kit (UG3)

The AccuLoad III to IV Upgrade Kit is designed to upgrade an AccuLoad III to AccuLoad IV. This upgrade kit enables customers with AccuLoad IIIs to upgrade their entire unit's technology with minimal downtime, reduced installation, and automation costs. The upgrade kit maintains the loading arm configuration being used in the AccuLoad III. The upgrade uses the AccuLoad III housing while replacing existing cover boards and software.[1] The upgrade kit gives AccuLoad III owners the opportunity to protect their operation and take advantage of the leading-edge features of AccuLoad IV without having to change their existing terminal automation or conduit system.

1   SA upgrade requires new MMI and replacing existing boards and software in the FCM.

Programmable Inputs/Outputs

AccuLoad ST, QT, and MMI

The AccuLoad ST and QT models are explosion-proof designs with an integrated 8.4-inch color touchscreen.

AccuLoad ST, ST-UG3, and N4 Hardware

Digital Inputs	AC	DC	Total
Standard	5	6	11
Optional A4I	5	16	21
Digital Outputs	**AC**	**DC**	**Total**
Standard	11	3	14
Optional (one A4I)	31	3	34
Analog inputs/outputs (up to six)			

AccuLoad QT and QT-UG3 Hardware

Digital Inputs	AC	DC	Total
Standard	9	14[2]	23
Optional (one A4I)	9	24	33
Optional (two A4Is)	9	34	43
Digital Outputs	**AC**	**DC**	**Total**
Standard	27	11[2]	38
Optional (one A4I)	47	11	58
Optional (two A4Is)	67	11	78
Analog inputs/outputs (up to six)			

AccuLoad SA

The AccuLoad IV SA model is flexible in that the FCM module can be supplied with one to four board sets.

AccuLoad IV-SA Hardware

Digital Inputs Per Board Set			Total			
Description	AC	DC	One Board Set	Two Board Sets	Three Board Sets	Four Board Sets
Standard	9	142	23	46	69	92
Optional A4I	9	242	33	66	99	122
Digital Outputs Per Board Set						
Description	AC	DC	One Board Set	Two Board Sets	Three Board Sets	Four Board Sets
Standard	27	11	38	76	114	152
Optional A4I	47	11	58	116	174	232
Analog inputs/outputs (up to six)						

Loading Arm Features

The AccuLoad loading arm functions are individually programmable—providing flexibility for how each arm can be configured. The AccuLoad ST, N4, as well as the UG3 hardware kit, supports up to four product meters that can be distributed among two loading arms, while the QT model's hardware enables six product meters that can be distributed among six loading arms. The SA model has the capacity for up to twenty-four product meters that can be distributed over 18 loading arms.

The AccuLoad IV has the flexibility of handling loading arm functions that include straight-product, sequential blending, straight-ratio blending, side-stream ratio blending, wild-stream blending and hybrid blending. Other arm functions include unloading and vapor-recovery system (VRS) operation.

Straight Product
A straight arm is used to deliver a single product through a single meter.

Sequential Blending
Sequential blending involves the blending of multiple products into a compartment through the sequencing of product-specific block valves. The products are blended, one at a time, flowing through one meter and control valve then flowing through a single loading arm into a compartment.

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2   *Eight of the direct current (DC) input/output (I/O) points are individually programmable as either inputs or outputs; the number indicated is the maximum if all programmed as inputs or all programmed as outputs.*

Ratio Blending

Ratio blending involves the blending of multiple products simultaneously through dedicated product lines. Each product line has its own meter and control valve, blending product in a common header and flowing through a single loading arm into a compartment.

Side-Stream Blending

Side-stream blending is blending a minor product (such as an additive) and a major product, where the minor product is metered and controlled by a valve and the major product is free flowing. A second meter and control valve downstream of the blending point, measures and controls the flow of the blended products. This is sometimes referred to as in-line blending.

Hybrid Blending

Hybrid blending is defined as a combination of sequential blending and ratio blending. A typical hybrid blending arm configuration may include three sequential products and one or two ratio products. The sequential products flow one at a time and, in most cases, one of the ratio products flows simultaneously with each of the sequential products. The ratio products can be plumbed either upstream or downstream of the sequential product meter. On a hybrid arm, the arms must have at least one sequential product configured.

Wild-Stream Blending

The wild-stream blending configuration is used in applications involving two products that are continuously blended where a preset volume is not normally used. One of the products can be uncontrolled (wild stream). This option is available with the hybrid-arm configuration. Wild-stream blending supports spontaneous blend-percent changes and meter changes to accommodate varying flow rates.

Unloading

The AccuLoad IV enables a vessel to be unloaded without entering a preset volume. Implementing this feature requires that a loading arm be identified as "unloading".

Vapor Recovery "Straight with VRS"

The vapor recovery arm type supports delivering a single product while monitoring the amount of vapor recovered. In order to utilize this feature, a loading arm type must be programmed as "Straight with VRS". Two meters are required for this application to determine the amount of vapor recovered while loading light density products. The AccuLoad provides a vapor product total and a net mass total between the liquid product meter and the vapor product meter in the system. This feature enables the AccuLoad to monitor the amount of vapor leaving a loading compartment while measuring and controlling the amount of product entering the same loading compartment. The product entering the compartment can be delivered in volume or mass. The vapor leaving the compartment must be measured in mass and requires the vapor recovery meter to be a mass meter.

Standard Features

Temperature Compensation

The temperature compensation option provides customers with the capability of compensating for the variance in temperature from a reference temperature. This option is used with a four-wire resistive-temperature detector (RTD) input or a temperature transducer and, excluding the accuracy of the fluid temperature measurement, will exactly match the proper volume correction factor of ASTM-D-1250-04 and API MPMS CH 11.1-2004 over the fluid temperature range of -58 °F to 302 °F (-50 °C to 150 °C). The following selections for API standard compensation methods can be programmed: API 2004 crude oils, API 2004 refined products, API E tables—special products API 2004 lube oils, API E tables—LPG, NGL, API Chapter 11.2.1M, API Chapter 11.2.2M, API 1952 tables 6, 23, 24, 53, and 54 (supported for asphalt), NH3—ammonia, TP-15 vapor pressure calculations conform to API 11.2.5, aromatic hydrocarbon products (ASTM D1555).

For light products such as NGL and LPG (E tables), calculations are performed per API Chapter 11.2.4 or GPA Technical Publication TP-27. The standard provides CTLs (correction for temperature on a liquid) calculated to five decimal digits (for example, 0.xxxxx or 1.xxxxx).

For ethanol compensation, selections are available to use API 11.3.3, EPA RFS2, Brazilian tables BR1A, BR1P, and BR2P, and PTB ethanol/gas equations.

Pressure Compensation

The pressure compensation option provides customers with the capability of compensating the volume of product delivered at varying pressures per API tables 11.1, 11.2.1, and 11.2.2, using a 4-20 milliampere (mA) pressure-transducer input per preset position. This option also contains real-time control functions for maintaining system pressures at the meter to a minimally-acceptable, user-definable level (pressure transducer not included). This option is particularly useful for light products, such as LPG, where the compressibility factor varies a great deal with different pressures.

Density Correction

The density correction option provides customers with the capability of correcting the volume of product delivered at varying densities. This can be either a frequency input or a 4-20 mA input.

Metered Injectors, Piston Injectors, and Smart Additives

The AccuLoad IV has been designed to provide maximum flexibility when it comes to additive control. The unit is capable of handling metered injectors, piston injectors, and smart additives simultaneously.

The AccuLoad is capable of controlling four additive-injector metered systems. (See Hardware Options for additional injector systems.) The AccuLoad controls the additive solenoids to precisely inject the additive into the main product. It monitors the pulses of the additive meter and controls the amount of the additive, based on the incoming pulses from the additive meter and the main product meter.

Additive monitoring and smart additives enable the AccuLoad to monitor feedback from the piston injectors of the additive products. The AccuLoad monitors the injector feedback switches for a change of state and counts the errors and alarms if no change is detected within the cycle or a period of time, depending on how the unit is programmed. The AccuLoad totalizes the additive volume based on confirmation signals and a programmable volume per cycle. The totalized volume prints on the emulated load ticket printed on the shared printer output.

For smart additives, the AccuLoad's firmware has also been designed with a primary/replica type of communication, with the AccuLoad being the primary and the additive injector system being the replica. The AccuLoad constantly interrogates the additive injector system for a change in status. The AccuLoad can be operated with communications control over the smart additive injector system or with communication/pulse control. When the AccuLoad has communication control over the additive system, it constantly monitors the additive system for its status, polls the additive totals, and signals the system when to inject the additive all through the communications line.

The AccuLoad communications package has also been designed with a pass-through communications mode. In this mode of operation, a supervisory computer can talk to the additive injector system through the communication lines run to the AccuLoad and from the AccuLoad to the additive injector systems.

Dual-Pulse Security

The AccuLoad can be configured to provide continuous monitoring, error indication alarm, and correction of the pulse transmission for each preset position[3] as per API Petroleum Measurement Standard, Chapter 5.5, Level A, and Institute of Petroleum Standard, IP 252/76, Part XIII, Section 1, Level A, or ISO 6551:1982. In order to use this feature, a transmitter capable of providing the proper pulse signal must be connected to the pulse inputs of the AccuLoad, such as the Smith Meter Universal Pulse Transmitter (UPT). The UPT provides four signals: "A," "A inverted," "B," and "B inverted." The A and B signals are 90 electrical degrees out-of-phase and used for dual-pulse security. The A and A inverted, and B and B inverted signals are 180 electrical degrees out-of-phase and are used for transmitter power sensing. If power sensing is not required, only A and B are required for dual-pulse security.

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3   *The use of the A inverted and B inverted signal inputs reduces the amount of available individual meter inputs.*

Automated-Proving Mode

The AccuLoad IV provides an automated proving mode of operation. When the automated proving mode is activated, the AccuLoad calculates the meter factor for a proving run based on information obtained during the prove. The operator can select the flow rate and meter factor that is being proved through the user interface of the AccuLoad. After the prove is completed the operator enters the prover volume and temperature. The AccuLoad then calculates the new meter factor and the operator has the choice of downloading it to the program or to ignore it. The AccuLoad also has the capability of providing an average meter factor over a maximum of six proves. This feature enables the operator to prove the meter on all four products, four meter factors, and associated flow rates for each product without having to enter the program mode for each product and meter factor.

Boolean and Algebraic Processing

The AccuLoad IV provides customers the flexibility to configure inputs and outputs for tasks that are not standard in the unit. Through Boolean processing, relays can be turned on and off through equations and events best suited for the application. For example, a relay is required to close at the first trip point of the load. A Boolean equation can be implemented with the required events to trigger this output in the software supplied in every Accuload IV.

Algebraic processing can be used by customers to perform mathematical calculations that are not part of the default software package. The results of these calculations can then be displayed on configurable reports for the current batch.

Hardware Options

AccuLoad Interface Module

The AccuLoad IV injector module (A4I) provides additional flexibility to the AccuLoad's standard features. The optional A4I module provides either 10 additional metered additive injector systems or 20 additional programmable outputs. This module provides the AccuLoad IV with the capability of handling up to fourteen metered injectors, 14 meter inputs, 14 solenoid valve outputs, and 14 additive pump outputs. Adding two A4I modules provides the capability to handle up to 24 additive injector systems (meters, additive pumps, and solenoid valves) or an additional 40 programmable alternating current (AC) outputs. The optional A4I modules are designed to either be mounted in the AccuLoad IV housing or in a stand-alone, remote-enclosure mount (REM).

Card-Reader Interface

The AccuLoad IV can obtain proximity card data through a proprietary interface board. The AccuLoad can also pass card data and statuses to a host computer. The card-reader interface is activated by choosing the card reader option in the serial communications function program code. This new interface offers the potential for enhanced functionality and security ranging from simple transaction-stamping with driver-card data to a mini automation system with validation and authorization.

MMI for SA Model

The Division 2-approved MMI can be ordered with optional green and red indicator lights, as well as a stop button. These are user-wired devices. The indicator lights can be used in place of the indicator lights on the overfill/ground system. The MMI can also be ordered with a proximity card reader. Refer to the Proximity Card Reader specification (SS06044) for details.

Fuse Holders for SA Model

Up to 50 fuse holders can be mounted in a Division 2 enclosure. These fuse holders can be used as additional protection for wiring to valve solenoids, etc.

Specifications

Accuracy

- **Calculated Accuracy:** The gross at standard temperature to gross volume ratio, excluding the accuracy of fluid temperature measurement, exactly matches the proper volume correction factor of ASTM-D-1250-04 over the fluid temperature range of -58 °F to 302 °F (-50 °C to 150 °C).

- **Temperature Measurement Accuracy:** Fluid temperature is measured to within ±0.72 °F (±0.4 °C) over the fluid temperature range of -328 °F to 572 °F (-200 °C to 300 °C). Fluid temperature is measured to within ±0.45 °F (±0.25 °C) over the fluid temperature range of 32 °F to 572 °F (0 °C to 300 °C).

- **Stability:** 0.1 °F (0.06 °C)/year

- **Flow Totalizing:** Within one pulse of input frequency

Electrical Inputs (Per Board Set on SA Model)

- **AC Instrument Power[4]:**
    - **Universal Input:** 100 to 240 voltage in alternating current (VAC), 58 watt (W) maximum, 48 to 63 hertz (Hz). The AC circuitry is fuse-protected.
    - **Surge Current:** 28 amp (A) maximum for less than 0.1 seconds
    - **Power Interruption Tolerance:** Interruption of power greater than .05 seconds (typical) will cause an orderly shut-down of the AccuLoad and the control valve will be signaled to close.

- **Pulse Input:**
    - **Type:** High-speed, edge-triggered, optically isolated pulse transmitter input
    - **Volts (V) (high):** 5 volts direct current (VDC) minimum to 28 VDC maximum
    - **Volts (low):** 1 VDC maximum
    - **Input Impedance:** 1.6 kiloohms (KΩ)
    - **Pulse Resolution:** 1 pulse/unit minimum, 9,999 pulses unit maximum
    - **Frequency Range:** 0 to 10.0 kilohertz (kHz)
    - **Response:** Within 1 pulse to a step change in flow rate
    - **Mode:** Single, dual, dual with power sensing, density
    - **Duty Cycle:** 35/65 to 65/35 (on/off)

- **Temperature Probe:**
    - **Type:** Four-wire, 100 ohms (Ω) platinum resistance temperature detector (PRTD)
    - **Temperature Coefficient:** 32 °F, 0.00214 Ω/Ω/ °F (0.00385 Ω/Ω/ °C)
    - **Temperature Range:** -148 °F to 572 °F (-100 °C to 300 °C)
    - **Offset:** Temperature probe offset is program-adjustable through the AccuLoad user interface in ±0.1 degree increments in the unit of temperature measurement used
    - **Self Calibrating:** Lead-length compensation that requires no resistance balancing of leads

- **Analog (4-20 mA):**
    - **Type:** Two-wire, 4-20 mA current loop receiver, isolated from ground, programmable as to function
    - **Span Adjustment:** Program-adjustable through the AccuLoad user interface or communication in tenths of the unit used
    - **Input Burden:** 50 Ω
    - **Accuracy:** ±0.025% of range when calibration factors are programmed
    - **Resolution:** One part in 65,536
    - **Voltage Drop:** 2 volts (V) maximum
    - **Sampling Rate:** One sample/300 millisecond (mSec) minimum

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4   *A constant voltage transformer (CVT) is recommended if the available AC power is suspected not to comply with these specifications.*

- **Analog (1-5 VDC):**
  - **Type:** Two-wire, 1 to 5 VDC voltage loop receiver, isolated from ground, programmable as to function
  - **Span Adjustment:** Program-adjustable through the AccuLoad user interface or communications in tenths of the unit used
  - **Input Burden:** 1 milliohm (mΩ)
  - **Accuracy:** ±0.025% of range when calibration factors are programmed
  - **Resolution:** One part in 65,536
  - **Sampling Rate:** One sample/300 mSec minimum

- **AC Inputs:**
  - **Type:** Optically-isolated, solid-state voltage sensor
  - **Input Voltage Range:** 90 to 280 VAC
  - **Pickup Voltage:** 90 VAC minimum
  - **Drop-Out Voltage:** 30 VAC maximum
  - **Current at Maximum Voltage:** 20 mA maximum
  - **Input Resistance:** 44,000 Ω typical

- **DC Inputs:**
  - **Type:** Optically-isolated solid state voltage sensors
  - **Input Voltage Range:** 5 to 28 VDC
  - **Pickup Voltage:** 5 VDC minimum
  - **Drop-Out Voltage:** Less than 1 V
  - **Current at Maximum Voltage:** 15 mA maximum
  - **Input Level Duration:** 120 mSec minimum

Electrical Outputs (Per Board Set on SA Model)

- **DC external power for ancillary equipment**: 24 VDC ±10%, 1 amp (A) maximum, short-circuit protected

- **AC Outputs:**
  - **Type:** Optically-isolated, AC, solid-state relays, user-programmable as to function
  - **Load Voltage Range**: 90 to 280 VAC (rms), 48 to 63 Hz
  - **Steady-State Load Current Range:** 0.025 amp (A) root mean square (rms) minimum to 1.0 amp (A) (rms) maximum into an inductive load
  - **Leakage Current at Maximum Voltage Rating:** 0.1 mA (rms) maximum at 240 VAC
  - **On-State Voltage Drop:** 1.5 VAC at maximum load

- **DC Outputs:**
  - **Type:** Optically-isolated solid-state output, user-programmable as to function
  - **Switch Blocking Voltage:** 30 VDC maximum
  - **Load Current:** 150 mA maximum with 0.6 V drop

- **Analog (4-20 mA):**
  - **Type:** Two-wire, 4-20 mA current loop transmitter, isolated from ground, programmable as to function
  - **Span Adjustment:** Program adjustable through the AccuLoad user interface or through communications
  - **Accuracy:** ±0.10% of range when calibration factors are programmed
  - **Resolution:** One part in 65,536
  - **Voltage Burden:** 4 V maximum

- **Analog (1-5 VDC):**
  - **Type:** Two-wire, 1-5 VDC voltage loop transmitter, isolated from ground, programmable as to function
  - **Span Adjustment:** Program adjustable through the AccuLoad user interface or through communications
  - **Accuracy:** ±0.10% of range when calibration factors are programmed
  - **Resolution:** One part in 65,536

- **Pulse Output 1 and 2:**
  - **Type:** Optically-isolated solid-state output; pulse output units are program-selectable through the AccuLoad user interface or communications
  - **Switch Blocking Voltage (Switch Off):** 30 VDC max
  - **Load Current (Switch On):** 10 mA with 0.6 V drop
  - **Frequency Range:** 8 to 2,500 Hz
  - **Duty Cycle:** 50%

- **Pulse Output 3, 4, and 5:**
  - **Type:** Solid-state relay digital output switch load current, 110 mA maximum
  - **Frequency Range:** 0 to 125 Hz
  - **Duty Cycle:** 50%
  - **Programmable Maximum Frequency Output:** All intended pulses will be eventually transmitted. The total period may increase to ensure all pulses are output.
    Note: When used, these outputs use the DC output points on the A4M (DC output 1 to 3 respectively).

- **Prover Pulse Output 1 and 2: High Speed Prover Output (Open Collector Opto Coupler)**
  - **Type:** Optically-isolated solid-state output
  - **Switch Blocking Voltage (Switch Off):** 30 VDC maximum
  - **Load Current (Switch On):** 10 mA with 0.6 V drop
  - **Frequency Range:** 0 to 3000 Hz
  - **Duty Cycle:** Duty cycle will mirror the meter's output duty cycle

Display/User Interface
- Integral alphanumeric/graphic
- 8.4 inch 800x600
- 24-bit color screen with a resistive touchscreen
- Day/night mode

Communications (Per Board Set on SA Model)

General
- **Number of Ports:** Four, plus ethernet port; (1) EIA-232, (1) EIA-485, (2) programmable for EIA-232 or EIA-485
- **Configuration:** Multi-drop network—up to 32 AccuLoads can be connected onto the same transmit and receive data lines, via serial communications. Standard IT practices should be followed when connecting multiple AccuLoads via an Ethernet hub, router, or switch.
- **Data Rate:** User interface-selectable to asynchronous data rates of 9,600, 19,200, 38,400, 57,600, or 115,200 bps (serial communication)
- **Data Format:** Programmable one start bit, programmable seven or eight data bits—even, odd, or no parity, one stop bit
- **Line Protocol:** Half-duplex, full-duplex, no character echo
- **Data Structure:** American Standard Code for Information Interchange (ASCII) character-oriented, modeled after Internal Organization for Standardization (ISO), Standard 1155
- **Protocol:** Smith Meter terminal mode, Smith Meter minicomputer mode, Modicon Modbus (PI-MBUS-300 Rev. D), Smith Meter and Modbus protocol over transmission control protocol/internet protocol (TCP/IP)
- **AccuLoad III Style:** Terminal mode, minicomputer mode

EIA-232
- **Type:** Interfaceable with EIA-232 data communication standards. Data transmitters are tri-state design.
- **Typical Applications:** Product receipt ticket printing can be used with a stand-alone ASCII printer or as a backup in the standby mode with automation for BOL emulation or communications with product management automation systems. Up to 16 AccuLoads can be connected onto the same transmit and receive data lines.

EIA-485

- **Type:** Interfacable with EIA-485 data communication standards
- **Typical Application:** Communicates with product management automation systems and additive injection systems
- **Number of Units Per Communication Line:** Up to 32 AccuLoads can be connected onto the same transmit and receive data lines

Ethernet:

- 10/100 base RJ-45
- EIA-568, category 5 or greater

- **Ethernet Connectivity Features**
  - Address resolution protocol/reverse address resolution protocol (ARP/RARP) and dynamic host configuration protocol (DHCP) support
  - PING echo diagnostics
  - Smith Meter protocol and Modbus protocol support over TCP/IP
  - HTTP server functionality
  - Dynamic name server lookups (DNS client)
  - Simple mail transport protocol (SMTP)
  - Post office protocol V3 (POP 3)
  - Support for network printers (LPR client)
  - Compliance with TCP/IP standards
  - Remote access using most browsers
  - Web-browser requirement for remote access:
    - Google Chrome: 44+
    - Internet Explorer: 10+
    - Firefox: 42+

Specifications (N4 Model and MMI Module)

- **Electrical Inputs**
  - **AC Instrument Power:**
    - **Universal Input:** 100 to 240 VAC, 58 W maximum, 48 to 63 Hz; the AC input circuitry is fuse protected
    - **Surge Current:** 28 amp maximum for less than 0.1 seconds

Optional Features

- **Red and Green Indicating Light Units**
  - **Electrical Ratings Bulbs:** LED lamp, universal voltage, 20 to 277 VAC or VDC, in red or green
  - **Terminals:** Saddle clamp type for one or two copper conductors 22-12 AWG (0.34 - 4.0 mm^2)

- **Stop Button**
  - **Electrical Ratings Contact Block:**
    - **NEMA Contact Rating Designator:** A600 (AC)
    - **Make and Emergency Interrupting Capacity:** 60 amps (120 V); 30 amps (240 V)
    - **Normal Load Break:** 6 amps (120 V); 3 amps (240 V)
    - **Thermal Current:** 10 amps
    - **Volt-Amperes:** Maximum make 7200; maximum break 720
    - **Contact Type:** 1NO-1NC (momentary) color: Black
      - **Button Color:** Black
      - **Terminals:** Stainless steel saddle clamp type for 1 x 18 - 14 American Wire Gauge (AWG) (0.75 - 2.5 mm^2) solid or stranded copper conductor.
- **Smith Meter Card Reader**
  - Can be added to the AccuLoad N4 or MMI
  - Provides integrally-mounted radio frequency-based (RF) proximity reader
  - Capable of interpreting multiple card formats and transmitting card data either to the AccuLoad or directly to an automation system. Refer to the Proximity Card Reader specification (SS06044) for details.

- **Card Interface (Optional)**
    - **Excite Frequency:** 125 kHz
    - **Typical Read Range:** Within up to 2 inches (5.08 cm)

Electrical Safety Approvals

Enclosure for ST and QT Models[5]

- Class I, Division 1, Groups C & D; UNL-UL Enclosure 4X, CNL-CSA Enclosure 4
- Class I, Zone 1, Group IIB, Class I, Zone 1, AEx d ia IIB T6 Gb, IP65 Tamb = -40 °C to +55 °C
- UL File E23545

European Union/International/Brazil
DEMKO 15 ATEX 1462X
IECEx UL 15.0016X
UL-BR 19.00058X
Ex d ia IIB T6 Gb IP 65 Tamb = -40 °C to +60 °C

Upgrade Kit UG3
- Classified by Underwriters Laboratories Inc. for usage with listed AccuLoad III
- UL File E204189
- For use with DEMKO 02 ATEX 130951X or IECEx UL 11.0018X certificate

Enclosure for N4 Model and MMI and FCM Modules[6]

- Industrial-type 304 stainless steel
- Class I, Division 2, Groups C & D; Class I, Zone 2, Group IIB T4
- Tamb = -40 °C to +50 °C, UNL-UL Enclosure 4X, CNL-CSA Enclosure 4
- UL File E23545

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5   *Temperature ratings for the enclosure is limited to +55 °C ambient for UL listed devices that are meant to be touched by an operator during normal operations.*

6   *The AccuLoad IV does not contain intrinsically-safe protected circuitry for field connections. Therefore, all peripheral equipment must be suitable for the area in which it is installed.*

Weights and Measures Certifications[7]

- United States NTEP Certificate of Conformance issued by the National Conference on Weights and Measures COC #99-141
- Canada (Measurement Canada): AV-2440
- Australia (National Measurement Institute[8]): NMI S472
- Brazil (INMETRO): DIMEL 252, 12 November 2019 (ALIV-XP-ST) and DIMEL 178, 14 August 2019 (ALIV-XP-QT)

The following reports have been issued by NMi (Netherlands Measurement Institute)[8]:
- Evaluation Certificate TC8664
- OIML R117-1 & R117-2 Test Report
- Welmec 7.2 Software Evaluation Test Report
- EU MID (Measuring Instrument Directive[8])
- MID Certificate Issued by PTB (National Metrology Institute of Germany)

Electromagnetic Compatibility (EMC)

- EMC Directive 2014/30/EU
- EN 61326-1: Electrical equipment for measurement, control and laboratory use

Environment[9]

- Ambient Operating Temperature: -40 °F to 140 °F (-40 °C to 60 °C)
- Humidity: 5 to 95% with condensation

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7   *Consult the factory for other weights and measures certifications.*

8   *Only models with ATEX and IECEx certifications.*

9   *Housing material is aluminum alloy. Severe salt environments are highly corrosive and protection and maintenance is required for such locations.*

Modeling Codes

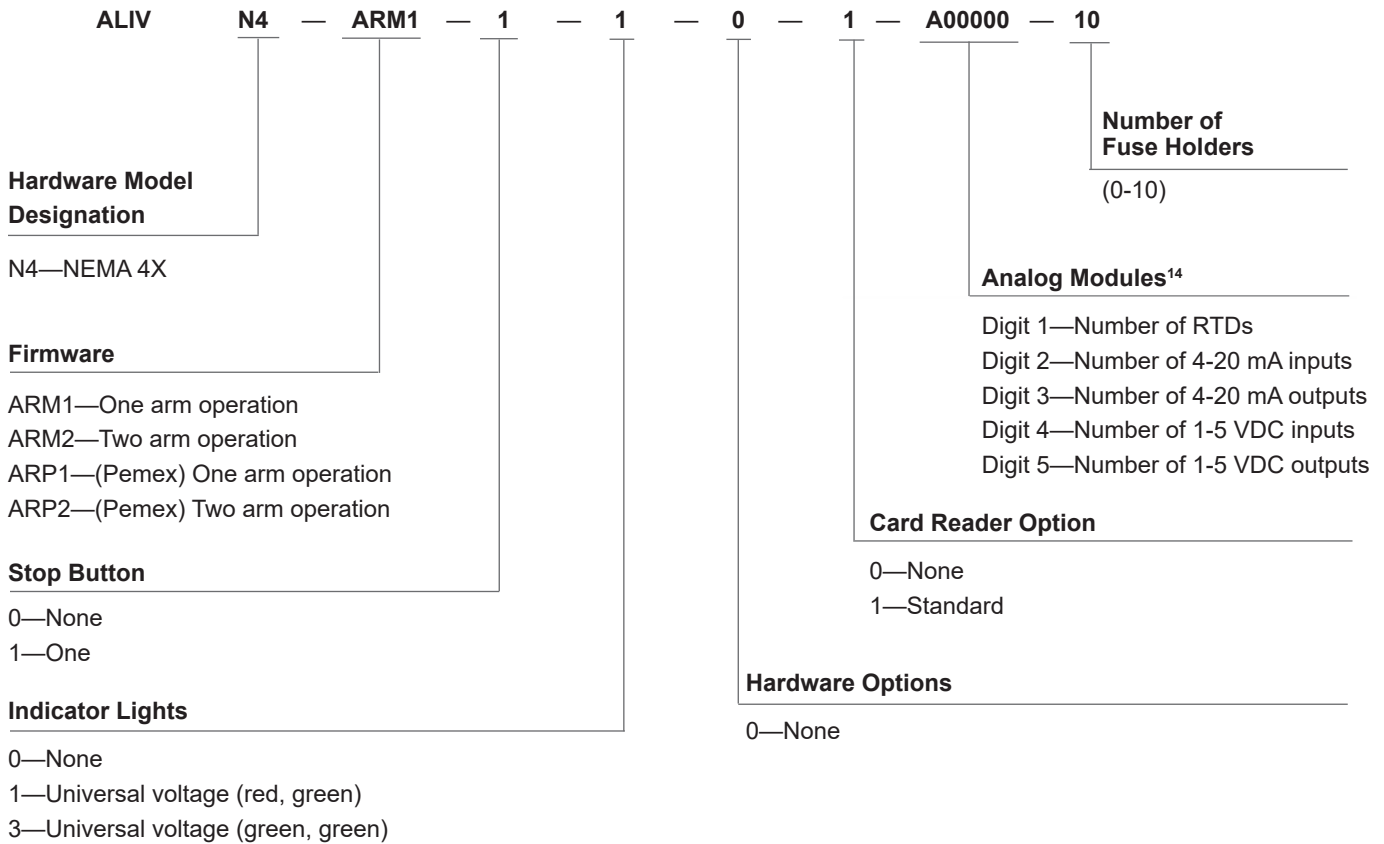## Modeling Code[10]—ALIV ST and ALIV QT

ALIV — QT — XP — ARM1 — A00000 — 1

Hardware Model Designation

ALIV—ST
ALIV—QT

Housing

XP—Explosion-proof housing
UG3—Upgrade kit for AccuLoad III

Hardware Option

0—None
1—A4I board
2—Two A4I boards[12]

Analog Modules[11]

DIGIT 1—Number of RTDs
DIGIT 2—Number of 4-20 mA inputs
DIGIT 3—Number of 4-20 mA outputs
DIGIT 4—Number of 1-5 VDC inputs
DIGIT 5—Number of 1-5 VDC outputs

Firmware

MMI
ARM1—One-arm operation   ARM4—Four-arm operation[12]
ARM2—Two-arm operation   ARM5—Five-arm operation[12]
ARM3—Three-arm operation[12]   ARM6—Six-arm operation[12]

PEMEX Non-Resettable Volumes Option

ARP1—One-arm operation   ARP4—Four-arm operation[12]
ARP2—Two-arm operation   ARP5—Five-arm operation[12]
ARP3—Three-arm operation[12]   ARP6—Six-arm operation[12]

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10 A complete model number is required when ordering the AccuLoad IV.

11 Maximum of six analog modules. For upgrade kits, existing analog modules in the AccuLoad III can be re-used in the AccuLoad IV UG3.

12 Not available with ALIV-ST hardware.

Modeling Code[10]—ALIV N4

ALIV N4 — ARM1 — 1 — 1 — 0 — 1 — A00000 — 10

Hardware Model Designation

N4—NEMA 4X

Firmware

ARM1—One arm operation
ARM2—Two arm operation
ARP1—(Pemex) One arm operation
ARP2—(Pemex) Two arm operation

Stop Button

0—None
1—One

Indicator Lights

0—None
1—Universal voltage (red, green)
3—Universal voltage (green, green)

Number of Fuse Holders

(0-10)

Analog Modules[14]

Digit 1—Number of RTDs
Digit 2—Number of 4-20 mA inputs
Digit 3—Number of 4-20 mA outputs
Digit 4—Number of 1-5 VDC inputs
Digit 5—Number of 1-5 VDC outputs

Card Reader Option

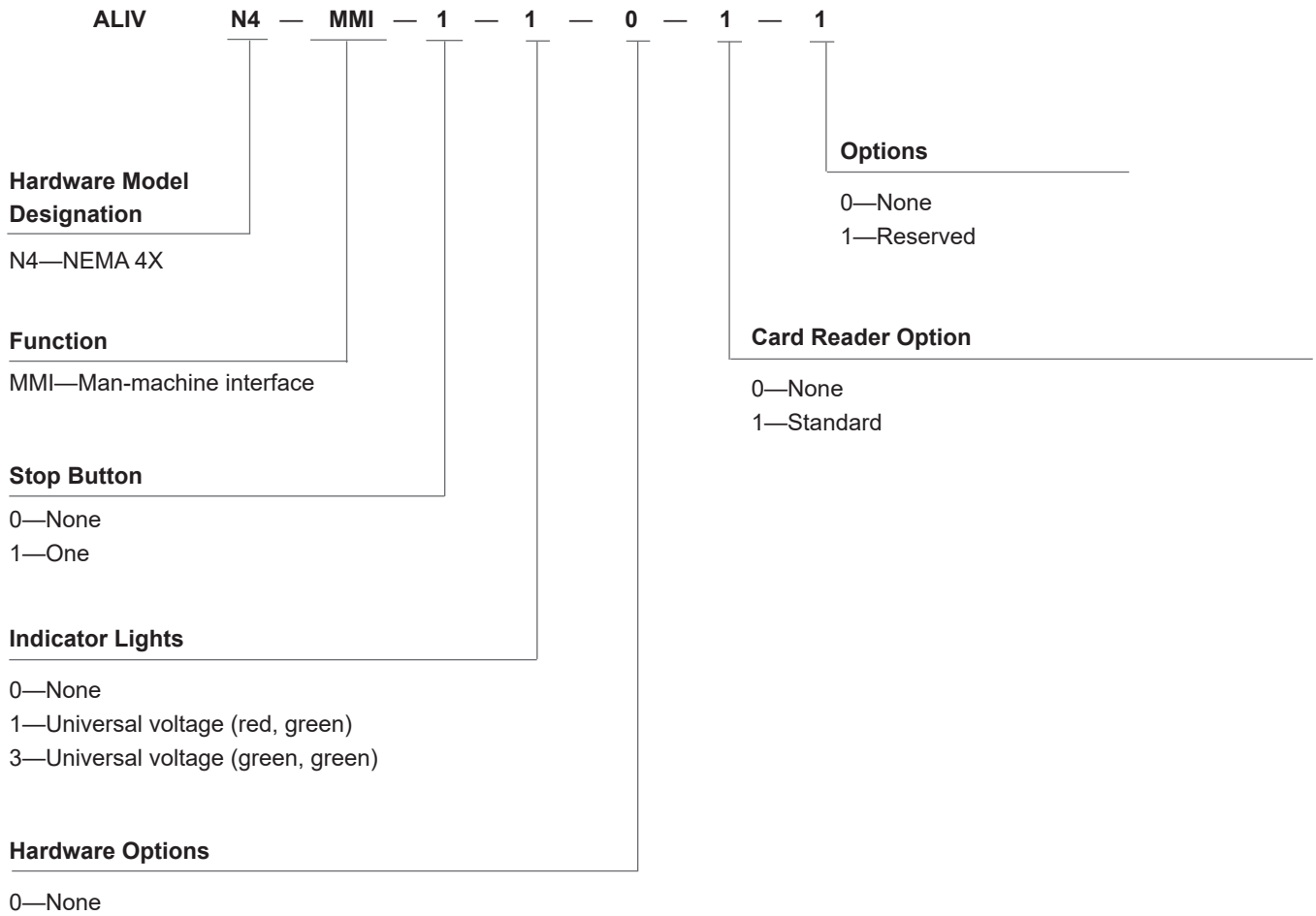0—None
1—Standard

Hardware Options

0—None

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10 *A complete model number is required when ordering the AccuLoad IV.*

14 *Maximum of six analog modules. For upgrade kits, existing analog modules in the AccuLoad III can be re-used in the AccuLoad IV UG3.*

Modeling Code[10]—ALIV SA MMI

ALIV   N4 — MMI — 1 — 1 — 0 — 1 — 1

Hardware Model Designation

N4—NEMA 4X

Function

MMI—Man-machine interface

Stop Button

0—None
1—One

Indicator Lights

0—None
1—Universal voltage (red, green)
3—Universal voltage (green, green)

Hardware Options

0—None

Options

0—None
1—Reserved

Card Reader Option

0—None
1—Standard

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10 *A complete model number is required when ordering the AccuLoad IV.*

Modeling Code[10]—ALIV SA FCM

```
ALIV    FCM  —  SA8  —  3  —  10
```

Hardware Model Designation

FCM—Flow control module
FMU—FCM upgrade kit for ALIII

Number of Loading Arms

SA1—One arm through SA18 - 18 arms

Number of Fuse Holders

0—50

Number of Board Sets

1—One (A4M, A4B)
2—Two (A4M, A4B)
3—Three (A4M, A4B)
4—Four (A4M, A4B)

Modeling Code[10]—ALIV SA Board Set Modeling[16]

When ordering a new AccuLoad IV SA FCM or FMU, also specify a model code for each board set to be included, as below:

```
ALIV    SAA    ARM2    A00000    1
```

Model Designation

SAA—Board set A
SAB—Board set B
SAC—Board set C
SAD—Board set D

Firmware

ARM1	ARP1 (Pemex) One arm operation
ARM2	ARP2 (Pemex) Two arm operation
ARM3	ARP3 (Pemex) Three arm operation
ARM4	ARP4 (Pemex) Four arm operation
ARM5	ARP5 (Pemex) Five arm operation
ARM6	ARP6 (Pemex) Six arm operation

Hardware Option

0—None
1—A4I board

Analog Modules[15]

Digit 1—Number of RTDs
Digit 2—Number of 4-20mA inputs
Digit 3—Number of 4-20mA outputs
Digit 4—Number of 1-5 VDC inputs
Digit 5—Number of 1-5 VDC outputs

Modeling Code[10]—ALIV SA Expansion Kit Board Set Modeling[16]

When expanding an AccuLoad IV SA system, specify the details using the following model code for each desired board set. These kits include additional hardware to mount the board into the ALIV-FCM or your upgraded ALIII-FCM.

```
ALIV    SAA    ARM2    A00000    1
```

Model Designation

FMXSAB—Board set B
FMXSAC—Board set C
FMXSAD—Board set D

Firmware

ARM1	ARP1 (Pemex) One arm operation
ARM2	ARP2 (Pemex) Two arm operation
ARM3	ARP3 (Pemex) Three arm operation
ARM4	ARP4 (Pemex) Four arm operation
ARM5	ARP5 (Pemex) Five arm operation
ARM6	ARP6 (Pemex) Six arm operation

Hardware Option

0—None
1—A4I board

Analog Modules[15]

Digit 1—Number of RTDs
Digit 2—Number of 4-20mA inputs
Digit 3—Number of 4-20mA outputs
Digit 4—Number of 1-5 VDC inputs
Digit 5—Number of 1-5 VDC outputs

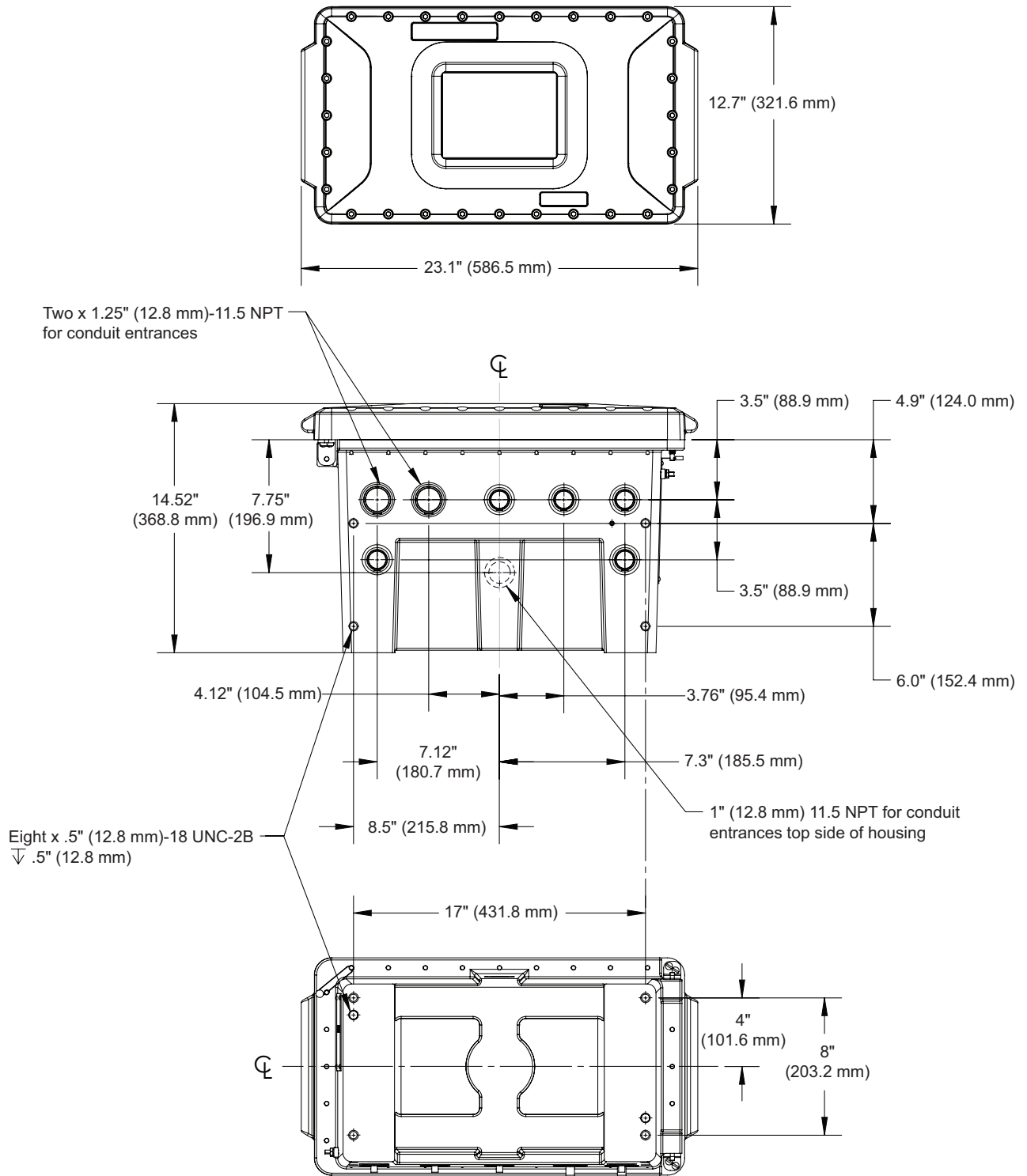10 *A complete model number is required when ordering the AccuLoad IV.*

15 *Maximum of six analog modules. For upgrade kits, existing analog modules in the AccuLoad III can be re-used in the AccuLoad IV FMU.*

16 *Board Set consists of one A4M and one A4B prior to optional hardware.*

Dimensions

Inches (mm)

QT Model

Two x 1.25" (12.8 mm)-11.5 NPT for conduit entrances

12.7" (321.6 mm)

23.1" (586.5 mm)

3.5" (88.9 mm)   4.9" (124.0 mm)

14.52" (368.8 mm)   7.75" (196.9 mm)

3.5" (88.9 mm)

6.0" (152.4 mm)

4.12" (104.5 mm)   3.76" (95.4 mm)

7.12" (180.7 mm)   7.3" (185.5 mm)

1" (12.8 mm) 11.5 NPT for conduit entrances top side of housing

8.5" (215.8 mm)

Eight x .5" (12.8 mm)-18 UNC-2B ▽ .5" (12.8 mm)
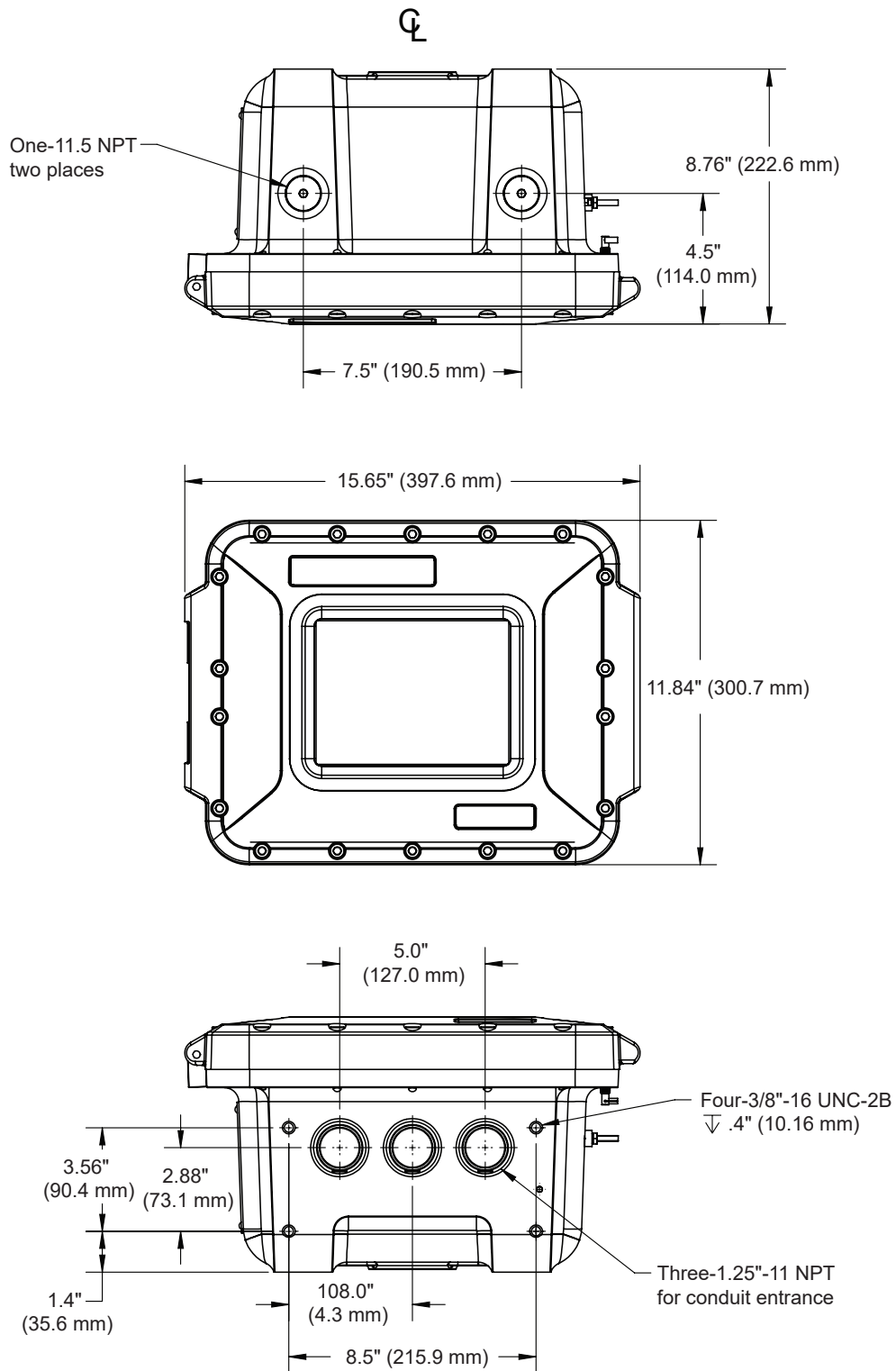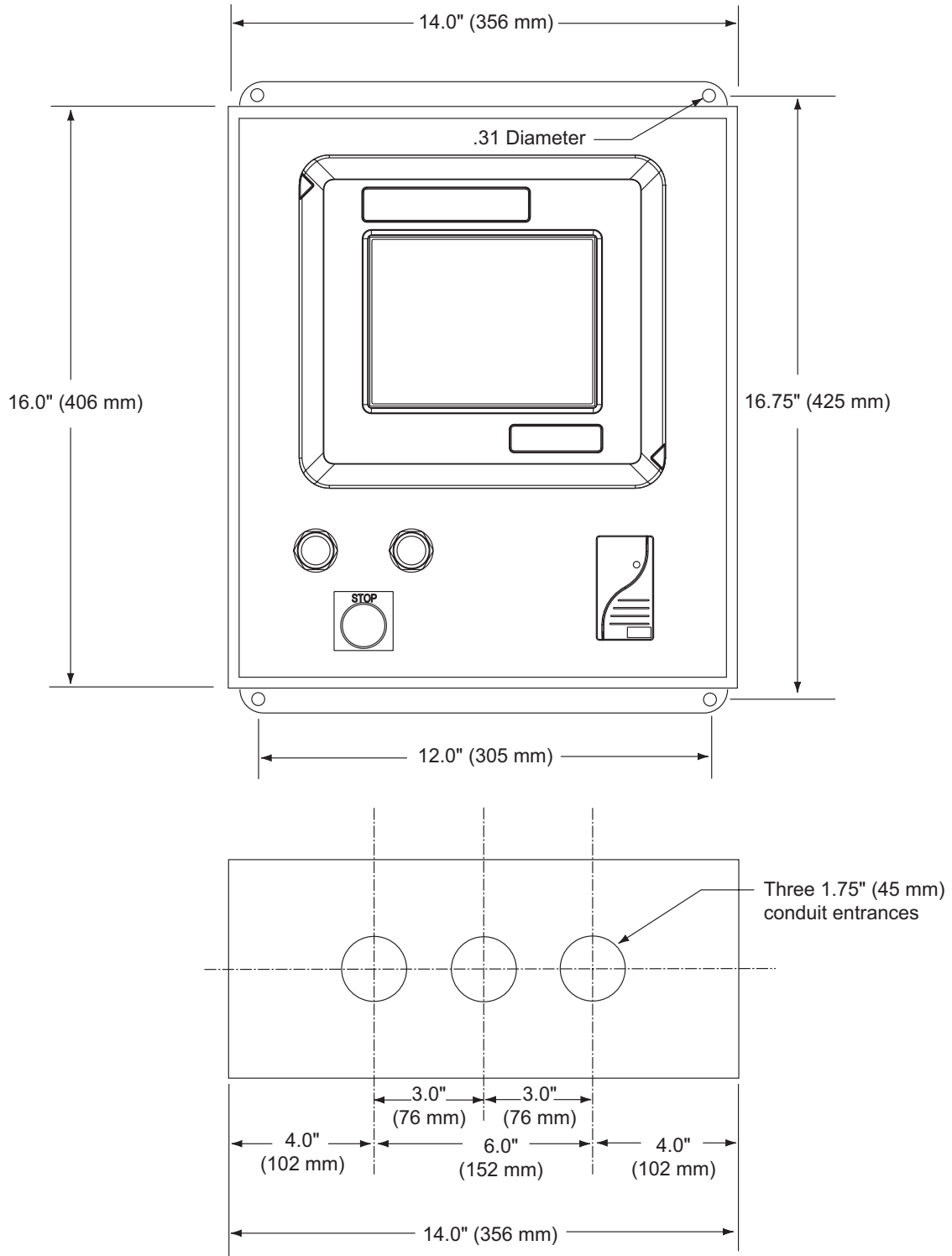
17" (431.8 mm)

4" (101.6 mm)   8" (203.2 mm)

Note: Dimensions—Inches to the nearest tenth (millimeters to the nearest whole mm), each independently dimensioned from respective engineering drawings.

Figure 1. AccuLoad IV QT Explosion-Proof Housing (125 lb/57.5 kg)

ST Model

Inches (mm)

One-11.5 NPT
two places

8.76" (222.6 mm)

4.5"
(114.0 mm)

7.5" (190.5 mm)

15.65" (397.6 mm)

11.84" (300.7 mm)

5.0"
(127.0 mm)

Four-3/8"-16 UNC-2B
▽ .4" (10.16 mm)

3.56"
(90.4 mm)

2.88"
(73.1 mm)

Three-1.25"-11 NPT
for conduit entrance

1.4"
(35.6 mm)

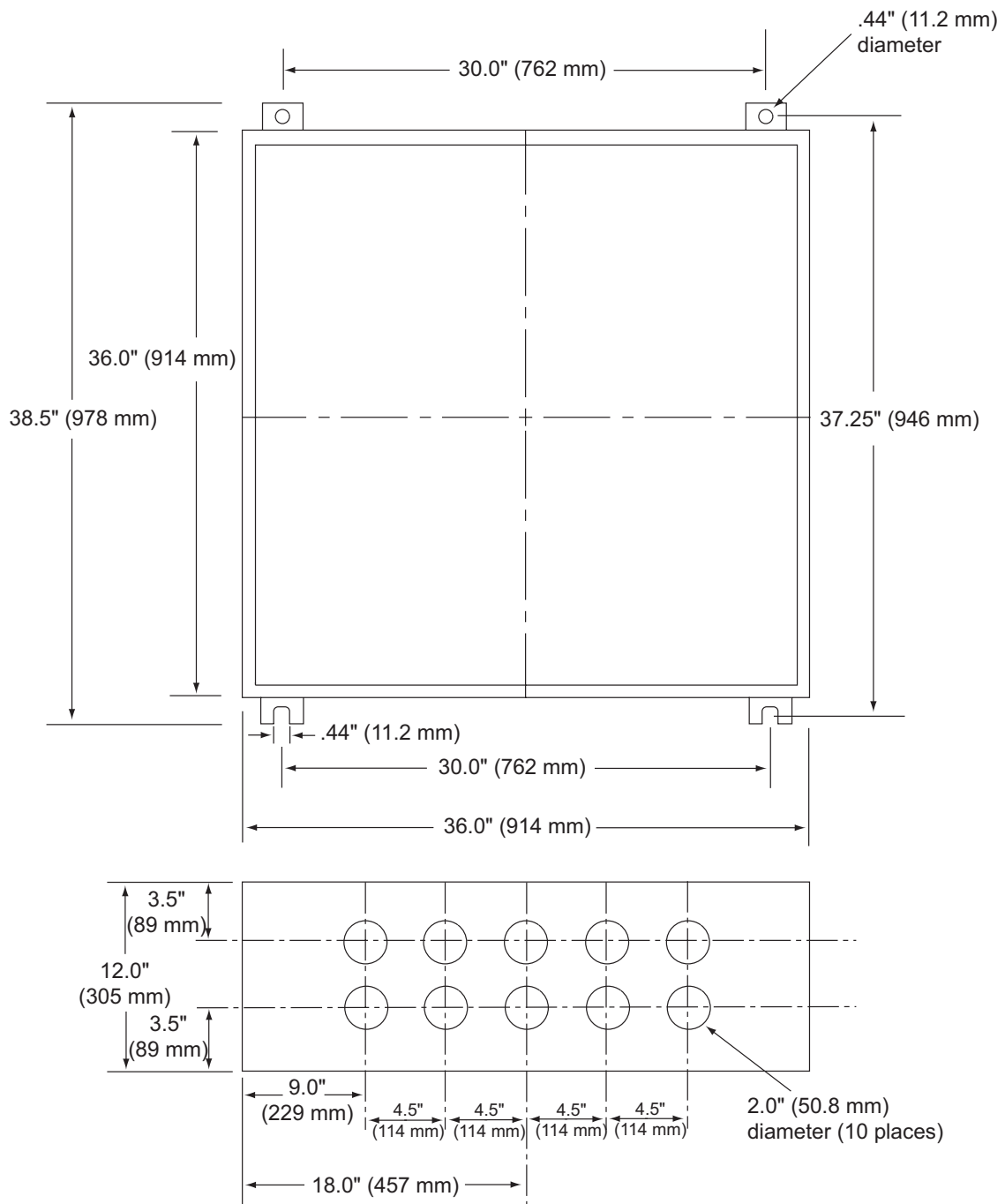108.0"
(4.3 mm)

8.5" (215.9 mm)

Note: Dimensions—Inches to the nearest tenth (millimeters to the nearest whole mm), each independently dimensioned from respective engineering drawings.

Figure 2. AccuLoad IV ST Explosion-Proof Housing (50 lb/22.7 kg)

N4 Model and MMI Module

Inches (mm)

Figure 3. AccuLoad IV N4 and MMI Housing (35 lb/15.9 kg)

Note: Dimensions—Inches to the nearest tenth (millimeters to the nearest whole mm), each independently dimensioned from respective engineering drawings.

FCM Module

Inches (mm)

Figure 4. AccuLoad IV FCM Housing (120 lb/54.54 kg)

REM for Remotely Mounted A4I Modules

Specifications (A4I Module)

Electrical Inputs

- **DC Instrument Power:** 24 VDC ± 10%, 1 W maximum
- **Pulse Input:**
    - **Type:** High-speed, edge-triggered, optically-isolated, compatible with contact closure, open collector or voltage sink/source pulse transmitter input
    - **V (High):** 10 VDC minimum to 24 VDC maximum
    - **V (Low):** Eight VDC maximum
    - **Pulse Resolution:** One pulse/unit minimum, 9,999 pulses/unit maximum
    - **Frequency Range:** 0 to 5 kHz
    - **Response:** Within one pulse to a step change in flow rate
    - **Minimum Pulse Width:** 50 µS

Electrical Outputs

- **AC Outputs:**
    - **Type:** Optically-isolated, AC, solid-state relays; user-programmable by the host as to function
    - **Load Voltage Range:** 90 to 280 VAC (rms), 48 to 63 Hz
    - **Steady-State Load Current Range:** 0.025A (rms) minimum to 0.5A (rms) maximum into an inductive load
    - **Leakage Current at Maximum Voltage Rating:** 0.1mA (rms) maximum at 240 VAC
    - **On-State Voltage Drop:** 1.5 Vac at maximum load
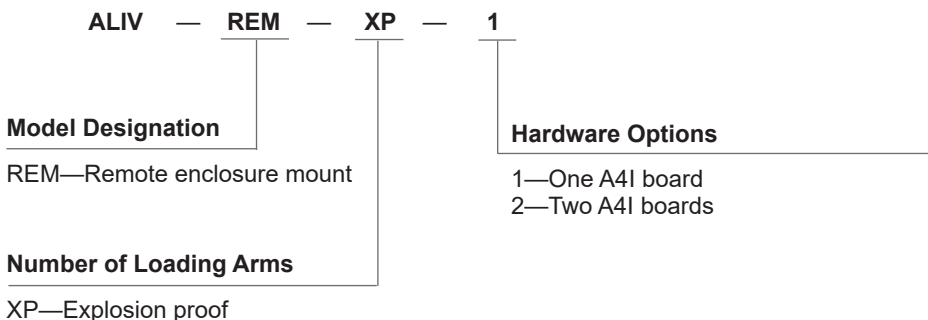
Environment

- **Ambient Operating Temperature:** -40 °F to 140 °F (-40 °C to 60 °C)
- **Humidity:** 5 to 95% with condensation
- **Remote Enclosure:** Explosion-proof (NEMA 7, Class I, Groups C and D) and watertight (NEMA 4X), IP65

Approvals

- **UL/CUL:**
    - Class I, Division 1, Groups C and D; Class II, Groups E, F, and G, UNL-UL Enclosure 4X, CNL-CSA Enclosure 4
    - Class I, Zone 1, AEx d IIB T6, IP65
    - UL File E23545

- **European Union/International**
    - DEMKO 11 ATEX 1103869X
    - IECEx UL 11.0029X
      Ex d IIB T6 IP65 Tamb = -40 °C to +60 °C

Modeling Code

Remote Enclosure Mount (REM)

ALIV — **REM** — **XP** — **1**

Model Designation

REM—Remote enclosure mount

Number of Loading Arms

XP—Explosion proof

Hardware Options

1—One A4I board
2—Two A4I boards

Dimensions
Inches (mm)

REM

2.5" (64 mm)

6.5" (165 mm)

13.4" (340 mm)

Weight of remote A4I housing is approximately 27 lbs.

10.4" (264 mm)

2.0" (51 mm)

6.2" (157 mm)

1.0" 11.5 NPT conduit entrance

1.5" (38 mm)

1.5" (38 mm)

1.25" 11.5 NPT conduit entrances typical 2 places

9.75" (248 mm)

Note: Dimensions—Inches to the nearest tenth (millimeters to the nearest whole mm), each independently dimensioned from respective engineering drawings.
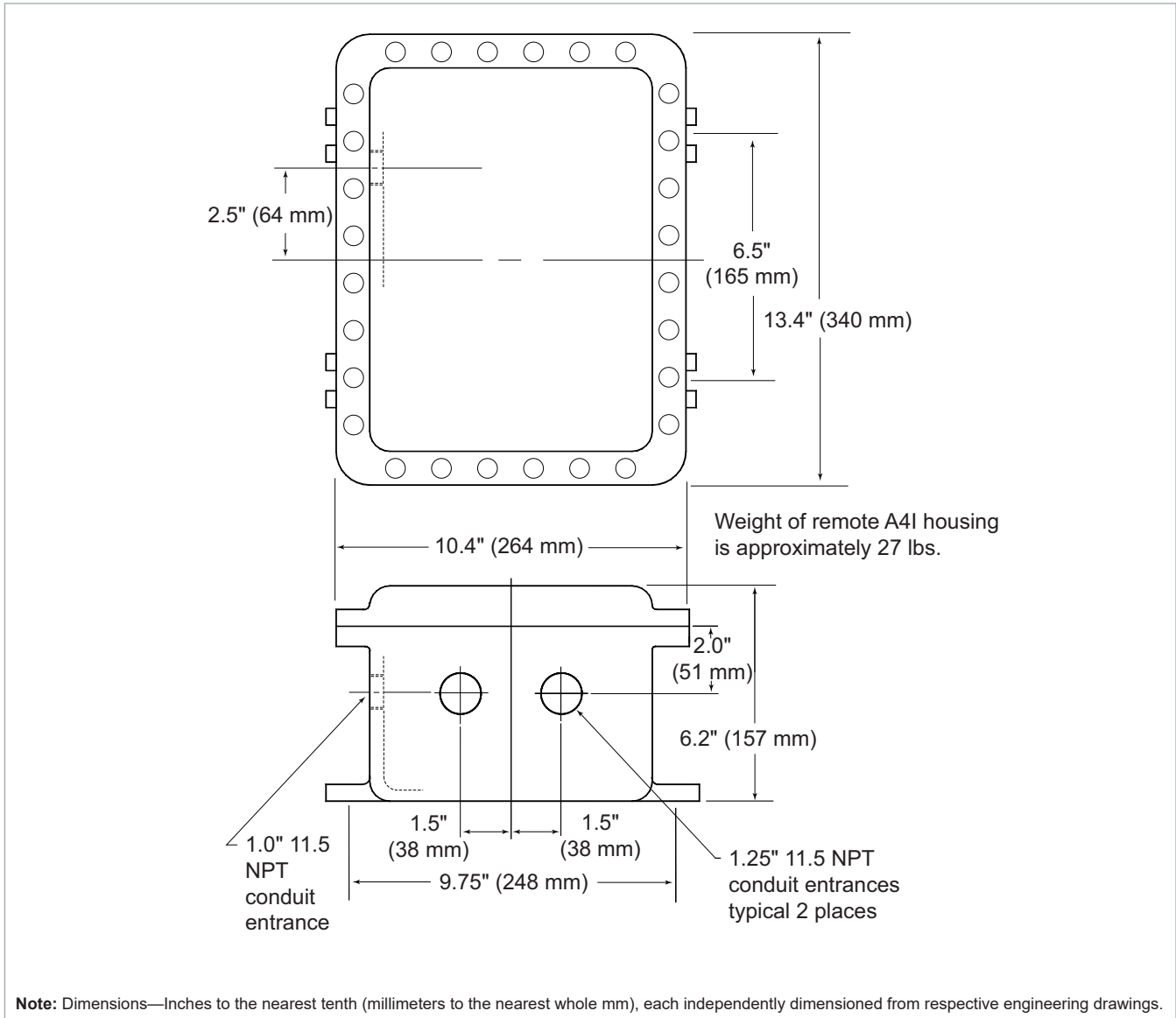
Figure 5. Remote Enclosure Mount Housing (Optional A4I) (27 lb/12.25 kg)

Revisions made to SS06200 Issue/Rev. 0.2 (14/21):
Modeling code indicator lights option 2 has been corrected to 3 for the N4 and MMI.

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