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Digital I/O Subsystem — model 91063A

Digital I/O Extender and Digital I/O Plug-Ins — model 91140A

Technical Data 9/76

Features

- Capacity expandable from 15 to 240 12-bit I/O card slots (up to 2880 digital I/O channels)
- Uses only one computer I/O channel
- Wide choice of digital I/O capabilities
- Software supplied for HP 2100S computers and 9600MX series computer systems
- Easily installed and serviced

Description

The 91063A Digital I/O Subsystem consists of a 6940A Multiprogrammer and interface for 2100 series Computers. It is standard in the 9611R Industrial Measurement and Control Station and is offered for the addition of digital I/O capability to the 9603R Scientific Measurement and Control Station.

Expandability

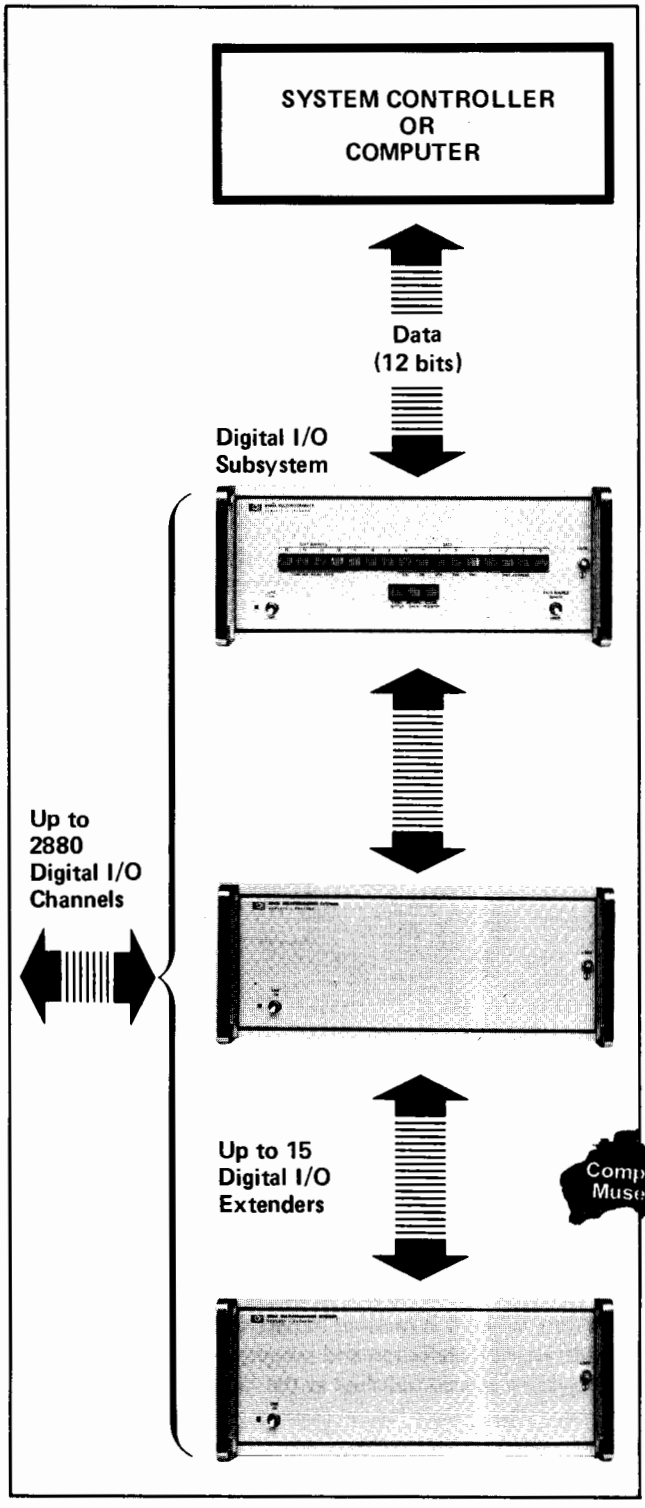
The basic capacity of the subsystem is 15 card slots for 12-bit I/O cards. Through the addition of 91140A digital I/O extenders, this capacity can be increased to 240 I/O card slots (15 in the subsystem mainframe and 15 more in each of 15 I/O extenders). The entire digital I/O subsystem connects to the computer via a single 16-bit microcircuit duplex register interface.

Wide Choice of Capabilities

Subsystem capabilities are offered as modular plug-in cards, including 12 channel status inputs, 12-channel event sense inputs, and event counter input. Both solid-state and relay contact outputs providing 12-channel capacity are offered. Other digital output choices include a stepping motor controller, a programmable timer, a stall alarm, and a frequency reference. The subsystem can also be equipped with both digital-to-analog current and voltage converters, each providing 12-bit resolution.

Industrial Connections and Signal Conditioning

The digital I/O subsystem plug-ins can be equipped with screw-terminal connection assemblies (option 010), which simplify connection of digital inputs and outputs. In their basic form, the screw terminals of these industrial connection assemblies connect directly to the input or output pins of the digital I/O subsystem plug-in modules, through the standard mating connector. However, voltages switched by external contact closures are sometimes incompatible with the



relatively low levels that are acceptable to the digital I/O subsystem input plug-ins. Similarly, the digital output signals available from the output plug-ins may not provide the drive required to energize controlled devices. To accommodate the fullest range of industrial requirements, two other versions of the connection assembly are offered, each providing a printed circuit board on which can be installed solid-state, plug-in ac or dc signal conditioning modules. These modules provide photo-isolated connection of digital inputs and outputs as shown in Figures 1 and 2. In addition to isolation, the signal conditioning provides for interfacing with the wide range of ac and dc digital I/o voltages normally encountered in the real world. This adaptability simplifies application of the digital I/O subsystem to user's needs.

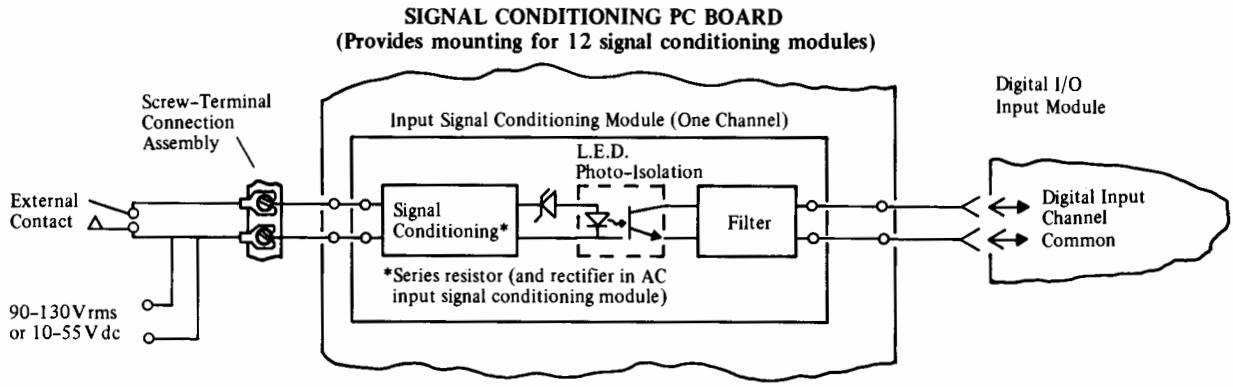


Figure 1. Digital Input Signal Conditioning

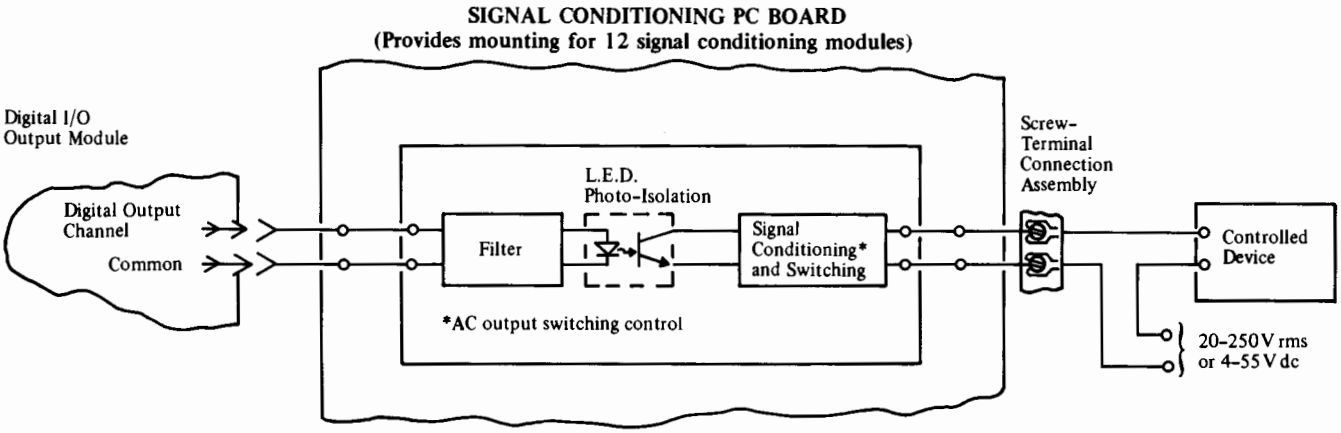


Figure 2. Digital Output Signal Conditioning

Easily Installed

With the user's choice of appropriate digital I/O cards, the subsystem is a complete package, virtually ready to use as soon as it is delivered. Simply rack mount the subsystem, plug one interface card into the computer, and connect the cable. The subsystem then needs only to be integrated into the software operating system (BCS, RTE-B, RTE-C, or RTE-II/III) of the computer to be ready for programmed operation. When it is ordered as part of a complete system, the subsystem installation and integration into the computer system is accomplished at the factory.

Easily Serviced

On-line diagnostics provide for remote checkout of the digital I/O subsystem. In the event of a malfunction, manual entry switches on the panel of the subsystem mainframe can be used to simplify and speed fault isolation. With these switches, any desired bit pattern can be sent to any card in the subsystem or any extender connected to it. Input states can be brought in from one channel and sent to another channel as part of a check on overall operation. This helps to quickly isolate a system malfunction to the digital I/O subsystem, interface, or computer, and helps to localize faults within the subsystem. Front panel access to all cards speeds completion of replacements or repairs when necessary.

Specifications

SUBSYSTEM and EXTENDER SPECIFICATIONS

Card Positions
15 in subsystem and each extender, up to 240 total with 15 extenders.

Maximum Data Resolution
12 bits.

Data Transfer Rate
20,000 digital words/sec, maximum.

Operating Conditions
0° to 40°C (32° to 104°F) ambient, allowing for 15°C (27°F) temperature rise inside system cabinet.

Power
Voltage: 115/230V ±10%, switch selectable.
Frequency: 48 to 440 Hz.
Power Consumption: 460W per subsystem and extender.
Microcircuit Interface: 0.05A (−2V) and 1.1A (+4.5V) drawn from computer or I/O extender.

Heat Dissipation
1570 BTU/hour per subsystem or extender at maximum power consumption.

Computer I/O Channels
One serves the subsystem and up to 15 extenders.

Physical Characteristics
Panel Height: 8-3/4 inches (222 mm) per subsystem and extender, including 1-3/4 inch blank panel space required for proper ventilation.
Weight: 38 lb. (17.3 kg) for subsystems, 34 lb. (15,4 kg) for each extender.

Subsystem Controls
Line On: Applies primary AC power.
Data Source: Selects remote/local.
16-Bit Switches: Enter words and address them to specific plug-in slot.
Load Output: Enters 16-bit switch pattern into the subsystem.
Clear Register: Clears all bits previously entered via the 16-bit switches.
Return Data: Generates a flag to computer, signaling data available on the return data lines.

Extender Controls
Line On: Applies primary AC power.

HARDWARE SUPPLIED

HP 91063A Digital I/O Subsystem:
HP 6940A Multiprogrammer, including AC power cable, 1-3/4 inch (45 mm) blank panel, and rack mounting assembly.
HP 12566B Interface Kit, including interconnecting cable.

HP 91140A Digital I/O Extender:
HP 6941A Multiprogrammer Extender, including AC power cable, 1-3/4 inch (45 mm) blank panel, and chaining cable.

SOFTWARE SUPPLIED

Diagnostic and Test Tapes
Optional Software (one of the following subsystem driver/interface routine options):

S30	BCS driver and FORTRAN/ALGOL driver interface
S50	RTE driver and FORTRAN/ALGOL driver interface
S60	RTE driver and RTE-B driver interface

SUBSYSTEM ORDERING INFORMATION

HP 91063A Digital I/O Subsystem.
HP 91140A Digital I/O Extender.

HP 91201A DIGITAL OUTPUT CARD SPECIFICATIONS

Data Output
Capacity: 12 bits.
"1" State: 0 to 0.3V, 32 mA max. sink current.
"0" State: +4.5 to 5V/+12V, jumper sel., 1k ohm source.

Gate Output
Low State: 0 to 0.3V, 32 mA max. sink current.
High State: +4.5 to 5V/+12V, jumper sel., 1k ohm source.
Interpretation: Change in level indicates data is present on output lines; signal reverts to original state at start or end of external device response period, as selected by jumper.

Flag Input
Low State: 0 to 0.5V, 15 mA max. source current.
High State: +2.4−5V.
Duration: 2 μsec, minimum.
Interpretation: Change in level indicates external device has received data; return to original level indicates external device has completed response period. Gate Output can be connected directly to Flag Input.

Option 001
Substitutes positive-true, ground-false logic (same data output levels) for ground-true, positive-false logic of standard 91201A Digital Output Card.

Option 010
Adds screw-terminal connection assembly for use in HP 9611R Measurement and Control Station.

Specifications

HP 91202A DIRECT DIGITAL INPUT CARD SPECIFICATIONS

Data Input
Capacity: 12 bits.
"1" State: 0 to 0.8V, 6 mA max. source.
"0" State: +2 to +5V, 1k ohm.

Gate Output
Low State: Saturation, 50 ohms, 11 mA max. sink.
High State: Cut off, 1k ohm, maximum.
Interpretation: Low state signals readiness for data from external source.

Flag Input
Low State: 0.08V, 6 mA max. source.
High State: †2 to +5V, 1k ohm.
Interpretation: High to low change indicates external device busy; return to high state indicates input is ready.

Option 001
Substitutes "1" level = 0 to 1V, 15 mA max. source and "0" level = +6 to +14V for standard data input levels; 40 mA max. sink for low state and cut off, 10k ohms, max. for high state of gate output; and 0 to 1V, 15 mA max. source for low state and +6 to +14V high state of flag input.

Option 002
Substitutes ground-false, positive-true logic (same data input levels) for ground-true, positive-false logic of standard 91202A Direct Digital Input Card.

HP 91203A ISOLATED DIGITAL INPUT CARD SPECIFICATIONS

Data Input
Capacity: 12 bits.
"1" State: 0 to 0.4V.
"0" State: +3.5 to +6V, 3 mA min. current.
Isolation: Up to 100V between data input lines and subsystem/extender common.

Option 001
Substitutes ground-false, positive-true logic (same data input levels) for ground-true, positive-false of standard 91203A Isolated Digital Input Card.

Option 002
Substitutes "1" level = +25 to 50V, 3 mA min. current and "0" level = 0 to 0.4V for standard data input levels.

Option 003
Substitutes "1" level = 0 to 0.4V and "0" level = +25 to +50V, 3 mA min. current for standard data input levels.

Option 010
Adds screw-terminal connection assembly for use in HP 9611R Measurement and Control Station. (Available only with standard HP 91203A Isolated Digital Input Card, not with option 001, 002, or 003.)

HP 91204A RELAY OUTPUT CARD SPECIFICATIONS

Data Output
Capacity: 12 normally-open contact pairs.
"1" State: closes contacts.
"0" State: opens contacts.
Operation Times: 3.5 millisec pull-in/release.

Contact Ratings
Type: Mercury wetted contacts.
Voltage: 100V dc or 100V rms, maximum.
Current: 1.0A switching.
Power: 20W, maximum.
Life: Over 100 x 10^6 operations/contact at full rating.
Resistance: 0.05Ω, max. throughout rated life.

Operating Position
Vertical in subsystem or extender; tilt of subsystem or extender must not exceed 30° in any direction.

Option 010
Adds screw-terminal connection assembly for use in HP 96MX systems.

HP 91205A EVENT SENSE INTERRUPT CARD SPECIFICATIONS

Applicability
Event sense interrupt card is usable only in HP 91063A subsystem mainframe, not in 91140A extender.

Data Input
"1" State: Contact open, >1 MΩ to common.
"0" State: Contact closed, <100Ω to common.
Integration Time: 10 millisec.
Capacity: 12 bits.

Basis of Interrupt
External data is compared to reference word, interrupt is issued to computer based on one of the following jumper-selected choices:
1. External data equal to reference word.
2. External data not equal to reference word.
3. External data less than reference word.
4. External data greater than reference word.

Option 010
Adds screw-terminal connection assembly for use in HP 9611R Measurement and Control Station

Option 011
For use in HP 9611R Measurement and Control Station. Adds screw-terminal connection assembly with mounting for 91210A AC input signal conditioning modules, which provide for 95-130V rms ac input.

Option 012
For use in HP 9611R Measurement and Control Station. Adds screw-terminal connection assembly with mounting for 91211A DC input signal conditioning modules, which provide for 10-55V dc input.

HP 91206A DIGITAL-to-ANALOG CURRENT CONVERTER SPECIFICATIONS

Output
Signal: 0 to 20.475 mA.
Compliance: 0 to 10.5V, output referenced to −15V (isolated).
Load Regulation: 2 μA, maximum over compliance range.
Resolution: 5 μA.
Accuracy: ±2.5 μA over entire compliance range at 25° ±5°C (77° ±9°F).
Temp. Coeff: ±0.6 μA per °C (±0.34 μA per °F).
24-Hour Stability: 1.5 μA max. drift after 1 hour warmup.

Programming Speed
10 μsec for digital transfer to card +30 μsec max. settling to within 5 μA of final value.

Ripple and Noise
2 mV p-p, maximum, dc to 400 kHz.

Remote Grounding
Either output lead may be grounded remotely, provided external ground-to-system ground differential is no more than 100V.

Prerequisite
One 91132A Voltage Regulator is required in each 91603A subsystem or 91140A extender containing a 91206A Digital-to-Analog Current Converter.

Option 010
Adds screw-terminal connection assembly for use in HP 9611R Measurement and Control Station.

HP 91207A DIGITAL-to-ANALOG VOLTAGE CONVERTER SPECIFICATIONS

Output
Signal: +10.235V to −10.240V, 0 to 5 mA, short circuit proof.
Load Regulation: ±3 mV, maximum, 0 to 5 mA.
Resolution: 5 mV.
Accuracy: ±5 mV, 0-5 mA output at 25° ±5°C (77° ±9°F).
Temp. Coeff: ±600 μV/°C (±333 μV/°F).
24-Hour Stability: ±1.5 mV max. drift after 1-hour warmup.

Programming Speed
10 μsec for digital transfer to card, +30 μsec max. settling to within 5 mV of final value.

Ripple and Noise
2 mV p-p, maximum, dc to 400 kHz.

Prerequisite
One 91132A Voltage Regulator is required in each 91063A subsystem or 91140A extender containing a 91207A Digital-to-Analog Voltage Converter.

Option 010
Adds screw-terminal connection assembly for use in HP 9611R Measurement and Control Station.

HP 91208A PROGRAMMABLE TIMER, STALL ALARM CARD SPECIFICATIONS

Output
Interval: Variable from 1 μsec to 409.5 sec, using combination of programmable increments from 1 to 4095 and choice of decade-multiple periods from x1 μsec to $x10^5$ μsec, selectable by 91204A Relay Card, or by fixed jumpers.
Timing Accuracy: 0.01% of programmed interval ±100 nsec.
Levels: Positive-true and negative-true TTL, each capable of driving 10 TTL standard loads.

Option 010
Adds screw-terminal connection assembly for use in HP 9611R Measurement and Control Station.

Option 011
For use in HP 9611R Measurement and Control Station. Adds screw-terminal connection assembly with mounting for 91212A AC solid-state relay modules, which provide for switching of 20-250V rms ac.

Option 012
For use in HP 9611R Measurement and Control Station. Adds screw-terminal connection assembly with mounting for 91213A DC solid-state relay modules, which provide for switching of 4-55V dc. Includes 200V, 3A inductive overshoot suppression diodes at the outputs.

HP 91209A FREQUENCY REFERENCE CARD SPECIFICATIONS

Output
Type: Square wave.
Frequencies: 1, 10, and 100 Hz and 1, 10, and 100 kHz.
Accuracy: 0.01% of nominal frequency.
Drivers: Open collector with 50 mA sink capability. Pullup resistor to +5V/+12V on card, or external supply to +30V can be added. Each output can drive up to three count inputs on separate 91221A Event Counter Cards.

Inhibit
Contact closure or low-state TTL logic level between inhibit line and common turns off the oscillator.

HP 91210A AC INPUT SIGNAL CONDITIONING MODULE SPECIFICATIONS

Applications
Up to 12 of these modules may be used with option 011 digital input cards to provide photo-isolated connection of AC inputs.

Input
Signal Voltage: 95 to 130 VAC rms at 47-63 Hz.
Load: 5.5-10 mA rms at 120 VAC.
Impedance: 18k ohms.

Operation Times
13 millisec typical turn-on/turn-off.

Isolation When Mounted
Dielectric Strength, Input to Output: 250V rms at 60 Hz.
Insulation Leakage Immunity: input current to 2 mA rms (typical) will not cause turn-on.

HP 91211A DC INPUT SIGNAL CONDITIONING MODULE SPECIFICATIONS

Application
Up to 12 of these modules may be used with option 012 digital I/O input cards to provide photo-isolated connection of DC inputs.

Input
Signal Voltage: 10 to 55 VDC.
Load: 10 mA ±25%.

Operation Times
2.5 millisec typical turn-on/turn-off.

Isolation When Mounted
Dielectric Strength, Input to Output: 250V rms at 60 Hz.
Insulation Leakage Immunity: input current to 3 mA DC will not cause turn-on.

HP 91212A AC SOLID-STATE RELAY MODULE SPECIFICATIONS

Application
Up to 12 of these solid-state relay modules may be used with option 011 digital output cards to provide photo-isolated AC switching.

Output
Voltage Rating: 20 to 250 VAC rms, 47-63 Hz.
Current Rating: 10 mA, min., to 3A, max., continuous; surge to 80A, max., for 16 millisec.

Switching Mode And Turn-On/Turn-Off
Module switches on only when line voltage crosses zero, switches off only when load current crosses zero. Turn-on takes 1/2 cycle (8.3 ms) maximum; turn-off takes one cycle (16.6 ms maximum at 60 Hz).

Dielectric Strength, Input to Output
500 VAC rms at 60 Hz.

HP 91213A DC SOLID-STATE RELAY MODULE SPECIFICATIONS

Application
Up to 12 of these solid-state relay modules may be used with option 012 digital output cards to provide photo-isolated DC switching.

Output
Voltage Rating: 4-55 VDC.
Current Rating: Up to 1.5A continuous, unidirectional.
Saturation Voltage Drop: 2V at 2A.

Operation Times When Mounted
Turn-on: 500 μsec maximum.
Turn-off: 3.0 millisec maximum.

HP 91220A STEPPING MOTOR CONTROL CARD SPECIFICATIONS

Application
This card generates pulses to either of two outputs, which are connected to the clockwise and counter-clockwise inputs of a user supplied stepping motor controller, such as SLO-SYN ST 1800B or Foxboro 137W.

Output
No. of Pulses: programmable from 1 to 2047.
Pulse Frequency: nominally 100 Hz, adjustable between 10 Hz and 2 kHz by changing components on card or connecting external resistor.
Low Level: 0 to 0.5V, 50 mA max. sink.
High Level: +4.75 to +5.25V or +12V unregulated, jumper selectable.
No. of outputs: Two program-selectable, one for clockwise drive, the other for counter-clockwise drive.

Flag Output
TTL high indicates output count is in progress (busy state); low indicates ready state.

Option 010
Adds screw-terminal connection assembly for use in HP 9611R Measurement and Control Station.

HP 91221A EVENT COUNTER CARD SPECIFICATIONS

Application
This card counts up or down in the range of 0 to 4095. Carry and borrow pulses generated when count goes above 4095 or below 0 permit counters to be cascaded. When used with the 91208A Programmable Timer or the 91209A Frequency Reference, the Event Counter may be used to measure frequencies or time intervals. A preset feature provides for counting a pre-determined number of events without intermediate polling by the computer.

Specifications

Input
Type: +5V, +12V, +24V, or contact closure pulse inputs for both up and down counting.
Frequency: to 10 kHz square wave (software limited).
Minimum Pulse Width: 2.5 μsec.
Maximum Rise Time: 5 μsec.
Enable Inputs: Open circuit or TTL high = enable; short circuit or TTL low = disable.
Common Mode Tolerance: up to 100V rms, max.

Outputs
Counter Output: 12 bit binary; drive capability is one TTL standard load.
Carry Output: TTL output goes high when count is incremented above 4095; drive capability is ten standard TTL loads.
Borrow Output: TTL output goes high when count is decremented below zero; drive capability is ten standard TTL loads.

Option 010
Adds screw-terminal connection assembly for use in HP 9611R Measurement and Control Station. Provides all connections except counter output.

Option 011
For use in HP 9611R Measurement and Control Station. Adds screw-terminal connection assembly with mounting for 91210A AC input signal conditioning modules, which provide for 95-130V rms ac digital input. Limits input count frequency to 20 Hz and requires 30 millisec signal duration. Provides all connections except counter output.

Option 012
For use in HP 9611R Measurement and Control Station. Adds screw-terminal connection assembly with mounting for 91211A DC input signal conditioning modules, which provide for 10-55V dc input. Limits input count frequency to 200 Hz and requires 3 millisec minimum pulse duration; provides all connections except counter output.

HP 91222A 12-BIT AC/DC STATUS INPUT SPECIFICATIONS

Application
For use in HP 9611R Measurement and Control Station to receive ac or dc digital inputs via ac or dc input signal conditioning modules. Must order either option 011 or 012.

Digital Input
Capacity: 12 bits.
"1" State: 95-130V rms ac (w/option 011 and 91210A AC signal conditioning modules) or 10-55V dc (w/option 012 and 91211A DC signal conditioning modules).
"0" State: Open circuit.

Option 011
Equips 91222A Status Input with screw-terminal connection assembly with mounting for 91210A AC input signal conditioning modules, which provide for 95-130V rms ac digital input.

Option 012
Equips 91222A Status Input with screw-terminal connection assembly with mounting for 91211A DC input signal conditioning modules, which provide for 10-55V dc digital input.

HP 91223A 12-BIT AC/DC DIGITAL OUTPUT SPECIFICATIONS

Application
For use in HP 9611R Measurement and Control Station to switch ac or dc digital outputs via ac or dc solid-state switch modules. Must order either option 011 or 012.

Digital Output
Capacity: 12 bits.
"1" State: Switches "on" 20-250V rms ac (w/option 011 and 91212A AC solid-state switch modules) or 4-55V dc (w/option 012 and 91213A DC solid-state switch modules).
"0" State: Open circuit.

Option 011
Equips 91223A Digital Output with screw-terminal connection assembly with mounting for 91212A AC solid-state switch modules, which provide for switching of 20-250V rms ac digital output.

Option 012
Equips 91223A Digital Output with screw-terminal connection assembly with mounting for 91213A DC solid-state switch modules, which provide for switching of 4-55V dc digital output. Includes 200V, 3A inductive overshoot suppression diodes at the outputs.

Specifications subject to change without notice.

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