Multifunction Control Card
40 digital I/O bits, 2 analog output channels, and 4 counters

Use the Model 3750 to monitor and control your automated test system. The flexibility and speed provided by the 40 digital I/O bits, four counters, and two analog outputs make it well-suited for a wide variety of system control applications.

Digital I/O
The Model 3750 offers 40 digital I/O bits arranged in five banks. Each bank is comprised of eight bits each, and each bank can be programmed as either input or output. Digital I/O is often used to control processes and monitor the status of switches, contacts, and other control points. Additional features include scanning capabilities, such as writing a unique output pattern or reading banks of inputs at rates up to 1000 rdgs/second. Also, pattern matching is available, making it ideal for complex event algorithms.

Further versatility is provided by supporting external voltage levels of up to 30V and output current sink levels of 300mA for control of external devices like RF/microwave relays.

Analog Outputs
The two analog outputs of the Model 3750 are designed for general purpose applications such as setpoint control or as bias supplies to your device under test. For maximum utility, these outputs are programmable as voltage (±12V) or current (0–20mA or 4–20mA). A number of protection features are provided, including monitoring for current and/or voltage compliance and the ability to disconnect automatically during fault conditions. Output relays are supplied for each channel, ensuring mechanical isolation between your control device and the analog output.

Counters
Four 32-bit counters are provided with a maximum input rate of 1MHz. Each counter has a gate input that offers precise control of event counting and totalizing for a broad range of system components, such as fixtures, limit switches, pass/fail indicators, revolutions, or time-related quantities. The counters, like the digital I/O, can be used in scanning operations and pattern matching as well as supporting reading rates of up to 1000 rdgs/second.

Self-calibration
When your Model 3706A mainframe is equipped with the high performance multimeter option, hardware and software is provided for self-calibration of analog outputs (voltage and current) and counter thresholds.

3750 Multifunction Control Card

ACCESSORIES AVAILABLE
- 3721-MTC-1.5 50-pin female-to-male D-sub Cable Assembly, 1.5m (4.9 ft)
- 3721-MTC-3 50-pin female-to-male D-sub Cable Assembly, 3m (9.8 ft)
- 3750-ST Screw Terminal Block
- 3790-KIT50-R 50-pin female D-sub Connector Kit (contains 2 D-sub connectors and 100 solder cup contacts)

SERVICES AVAILABLE
- 3750-5Y-EW-STD 5-year factory warranty extended to 5 years from date of shipment
- 3750-3Y-EW-STD 3-year factory warranty extended to 3 years from date of shipment
- C-3750-3Y-DATA 3 (2540-1 compliant) calibrations within 3 years of purchase*

*Not available in all countries

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A Greater Measure of Confidence
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Figure 1. Block diagram

Simplified Digital I/O Schematic

Optional Jumper

Logic Supply (50mA max.)

V EXTERNAL (VEXT1, VEXT2) (30V max.)

Self Resetting

System 5V

Pull-up Voltage (8 DIO)

Pull-up Resistor ~68kΩ

Input

10mA max. Sourcing Only

Output

300mA max. Sinking Only

Digital Inputs

Digital Outputs

8 Bits

Total of 5 banks

8 bits per bank

Counter 1

Gate +

Gate –

TTL or AC

Input +

Input –

32 Bit Count

Total of 4 counters

Figure 2. Simplified I/O schematic

Specifications

DIGITAL I/O

CONFIGURATION: 40 bidirectional digital I/O bits arranged in 5 banks of 8 bits each. Each bank can be configured for either input or output capability. 1 bank of I/O is equivalent to 1 system channel.

DIGITAL INPUT SPECIFICATIONS

An internal weak pull-up resistor of approximately 68kΩ is provided on the card for each I/O. This pull-up resistor can be removed via onboard jumper on a channel (8 bit) basis. The pull-up voltage can either connect to the internally supplied 5V or an externally supplied voltage of up to 30V via onboard jumper. An internal 5V supply connection is separately available to run external logic circuits.

DIGITAL INPUT LOGIC LOW VOLTAGE: 0.8V max.

DIGITAL INPUT LOGIC HIGH VOLTAGE: 2V min.

DIGITAL INPUT LOGIC LOW CURRENT: -600µA max @ 0V.

DIGITAL INPUT LOGIC HIGH CURRENT: 50µA max @ 5V.

LOGIC: Positive true.

SYSTEM INPUT MINIMUM READ SPEED: 3000 readings/second.

MAXIMUM EXTERNALLY SUPPLIED PULL-UP VOLTAGE: 30V

MAXIMUM EXTERNALLY SUPPLIED VOLTAGE TO ANY DIGITAL I/O LINE: Pull-up voltage (5V internal or up to 30V external).

DIGITAL OUTPUT SPECIFICATIONS

Each output has an internal fly-back diode for driving inductive loads. Each output is protected against continuous short circuits and over temperature. An internal 5V supply connection is separately available to run external logic circuits.

DIGITAL OUTPUT LOGIC HIGH VOLTAGE: 2.4V minimum @ Iout = 10mA, sourcing only.

DIGITAL OUTPUT LOGIC LOW VOLTAGE: 0.5V maximum @ Iout = -50mA, sinking only.

MAXIMUM OUTPUT SINK CURRENT: 300mA per output, 3.0A total per card.

LOGIC: Positive true.

SYSTEM OUTPUT MINIMUM WRITE SPEED: 1000 readings/second.

MAXIMUM EXTERNALLY SUPPLIED VOLTAGE TO ANY DIGITAL I/O LINE: Pull-up voltage (5V internal or up to 30V external).

ALARM: Trigger generation is supported for a maskable pattern match or state change on any of channels 1 through 5.

PROTECTION: Optional disconnect (set to inputs) during output fault conditions.

INTERNAL 5V LOGIC SUPPLY: The internal logic supply is designed for powering external logic circuits of up to 50mA maximum. The logic supply is internally protected with a self-resetting fuse. Fuse reset time < 1 hour.

NOTES
1. All channels power up configured as inputs.
2. All channels configured as inputs.
3. All channels configured as outputs.

Model 3750 Specifications

Channels 1–5: Bidirectional, high current digital I/O (40 bits)

Channels 6–9: 32-bit counters (4 counters)

Channels 10–11: Isolated voltage or current analog outputs (2 each)
### Model 3750 Specifications

#### COUNTER/TOTALIZER INPUT
- **Maximum Count:** $2^n - 1$.
- **Maximum Input Rate:** 1MHz, rising or falling edge, programmable.
- **Minimum Input Pulse Width:** 500ns.
- **Input Signal Level:** 200mV p-p (minimum), 42V peak (maximum).
- **Threshold:** AC (0V) or TTL logic level.
- **Gate Input:** TTL–HI (Gate+), TTL–LO (Gate–) or NONE.
- **Minimum Gate Input Setup Time:** 1μs.
- **Count Reset:** Manual or Read + Reset.
- **System Input Minimum Read Speed:** 1000 readings/second.
- **Alarm:** Trigger generation is supported for a count match or counter overflow on any of channels 6 through 9.

#### Analog Voltage Output
- The isolated analog voltage output is designed for general purpose, low power applications.
- **Output Amplitude:** ±12V up to 10mA.
- **Overload Current:** 21mA minimum.
- **Resolution:** 1mV.
- **Full Scale Settling Time:** 1ms to 0.1% of output.
- **DC Accuracy** ($\pm$% of output + mV):
  - 1 Year: $23^\circ \pm 5^\circ$: 0.15% + 16mV
  - 90 Day: $23^\circ \pm 5^\circ$: 0.1% + 16mV
  - 24 Hour: $23^\circ \pm 5^\circ$: 0.01% + 16mV
- **Temperature Coefficient:** ±(0.02% + 1.2mV)/°C.
- **10mV Maximum Update Rate:** 350µs to 1% accuracy. System limited.
- **Output Fault Detection:** System fault detection is available for short circuit output/current compliance.
- **Isolation:** 300V peak channel to channel or channel to chassis.
- **Protection:** Optional disconnect during output fault conditions.
- **Minimum Guaranteed Stable Capacitive Load:** 10mF.

#### Analog Current Output
- The isolated analog current output is designed for 0–20mA or 4–20mA unipolar modes of operation.
- **Output Amplitude:** 0 to 20mA or 4 to 20mA.
- **Compliance Voltage:** 11V minimum.
- **Maximum Open Circuit Voltage:** 16V.
- **Resolution:** 1µA.
- **Full Scale Settling Time:** 1ms to 0.1% of output.
- **DC Accuracy** ($\pm$% of output + µA):
  - 1 Year: $23^\circ \pm 5^\circ$: 0.15% + 18µA
  - 90 Day: $23^\circ \pm 5^\circ$: 0.1% + 18µA
  - 24 Hour: $23^\circ \pm 5^\circ$: 0.01% + 18µA
- **Temperature Coefficient:** ±(0.02% + 1.6µA)/°C.
- **Output Fault Detection:** System fault detection is available for open circuit output/voltage compliance.
- **Isolation:** 300V peak channel to channel or channel to chassis.
- **Protection:** Optional disconnect during output fault conditions.

#### Notes
1. Programming up to 1% over full scale range is supported.
2. Measured with standard load shown in Figure 3.
3. Measured with >100mA input DMM (DCC filter, 1 PLC rate).
4. Warm-up time is 1 hour @ 3750-ST.

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**General**

- **Connector Type:** Two 50-pin male D-shells.
- **Operating Environment:** Specified for 0ºC to 50ºC. Specified to 70% R.H. at 35ºC.
- **Storage Environment:** -25ºC to 65ºC.
- **Weight:** 1.27kg (2.80 lbs).
- **Safety:** Conforms to European Union Directive 73/23/EEC, EN61010-1.
- **EMC:** Conforms to European Union Directive 2004/108/EC, EN61326-1.
- **Power Budget Information:**
  - Quiescent Power: 350mW
  - Digital Outputs Each Channel (1 through 5): 325mW
  - Analog Channel Each (10 and 11): 820mW
  - Totalizer Channel All (6 through 9): 730mW
- Analog channels and counter channels may optionally be turned off to conserve system power.
- See Chapter 8 of the Series 3700A user’s manual for more detailed information.

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**Figure 3. Standard load test circuits**