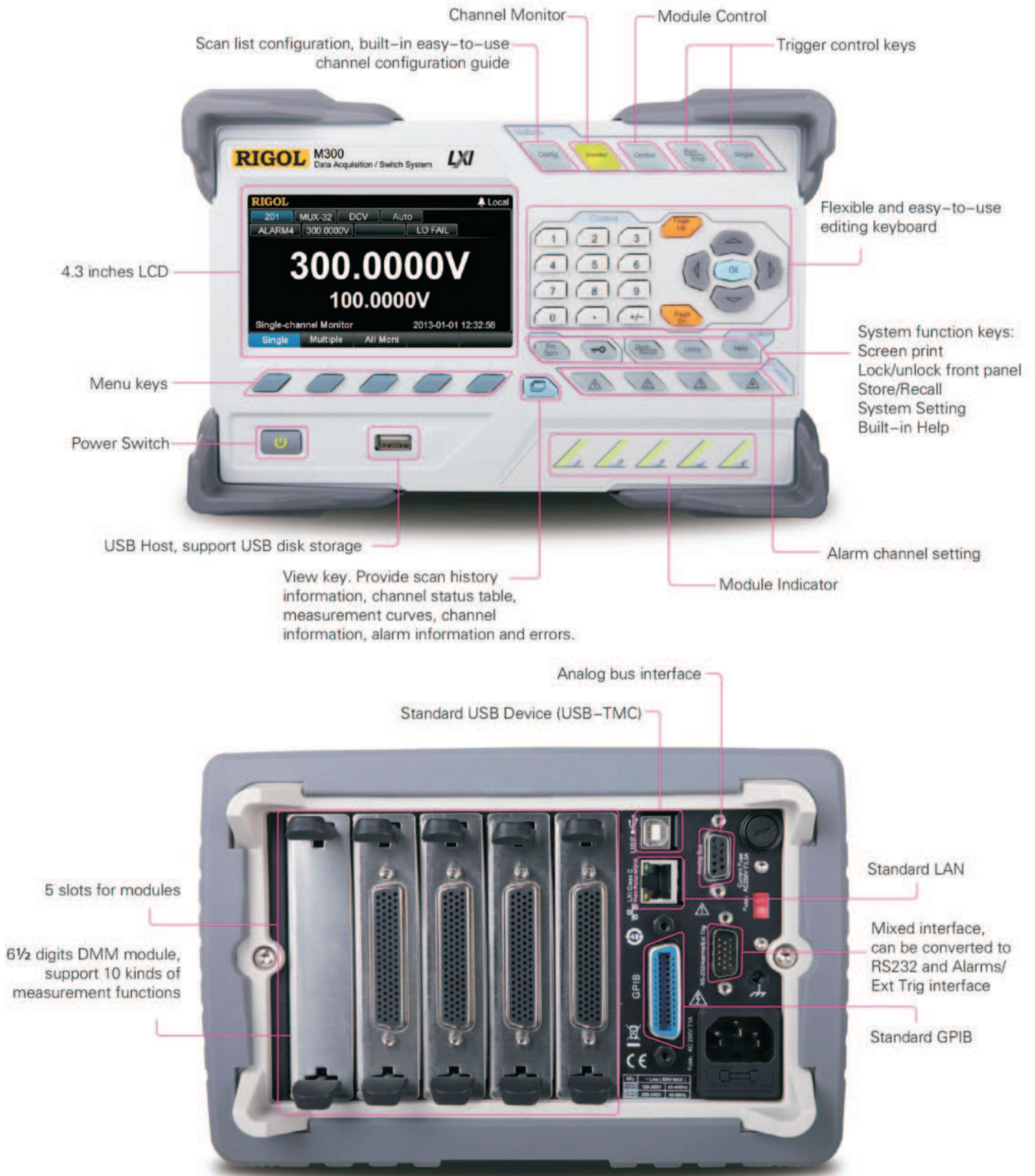**RIGOL**



# M300 Series
# Data Acquisition/ Switch System

- Up to 320 switch channels per mainframe, save on cost of ownership
- Can be run without PC
- USB logging
- Interval scanning with storage of up to 100,000 time-stamped readings
- 8 kinds of cards supported
- 6½ digits DMM can be enabled/disabled in any of slots
- Standard SCPI commands
- Math statistics: AVG, MAX, MIN, SDEV
- 4.3' TFT LCD
- Powerful PC software
- Full Interfaces supported: USB Device,USB Host, GPIB, LAN(LXI-Core 2011 Device), RS232

M300 Series Data Acquisition/Switch System with modular structure, which combines precision measurement capability with flexible signal connections, can provide versatile solutions for the applications with multiple points or signals to be tested in product performance test during R&D phase as well as automatic test during production process.

# M300 Series Data Acquisition/Switch System

Channel Monitor

Module Control

Scan list configuration, built–in easy–to–use channel configuration guide

Trigger control keys

RIGOL M300
Data Acquisition / Switch System  LXI

Flexible and easy–to–use editing keyboard

4.3 inches LCD

RIGOL
Local
201  MUX-32  DCV  Auto
ALARM4  300.0000V  LO FAIL

300.0000V
100.0000V

Single-channel Monitor          2013-01-01 12:32:56
Single  Multiple  All Moni

System function keys:
Screen print
Lock/unlock front panel
Store/Recall
System Setting
Built–in Help

Menu keys

Power Switch

Alarm channel setting

USB Host, support USB disk storage

Module Indicator

View key. Provide scan history information, channel status table, measurement curves, channel information, alarm information and errors.

Analog bus interface

Standard USB Device (USB–TMC)

5 slots for modules

Standard LAN

6½ digits DMM module, support 10 kinds of measurement functions

Mixed interface, can be converted to RS232 and Alarms/ Ext Trig interface

Standard GPIB

Product Dimensions: Width X Height X Depth=239.0mm×159.0 mm×373.4 mm Weight: 5.7 kg(Without Package)
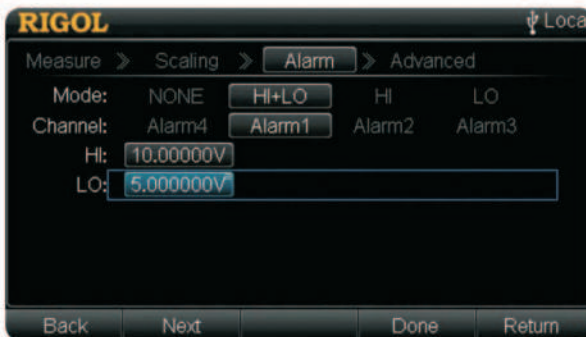
## ▶ Feature and Benefits

### · Channel Configuration Guide
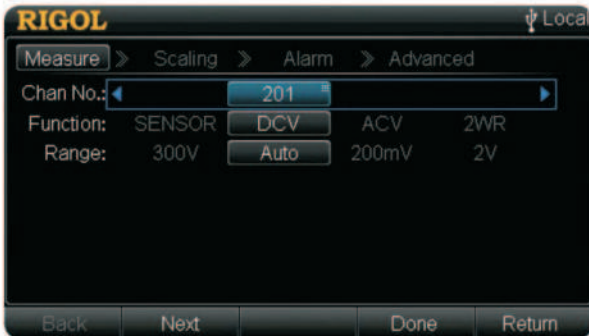


Measurement Configuration
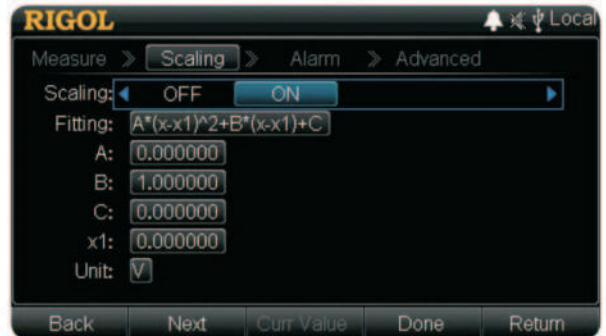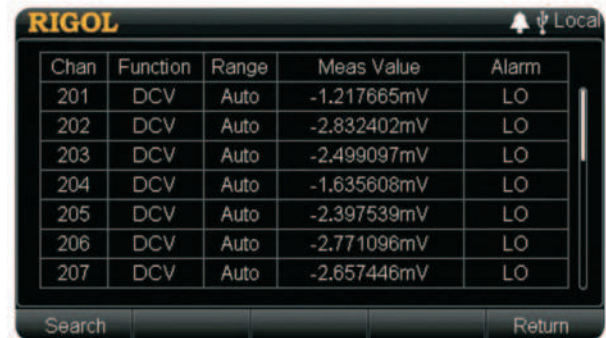


Scaling Configuration



Alarm Configuration



Advanced Configuration

### · Channel Monitor
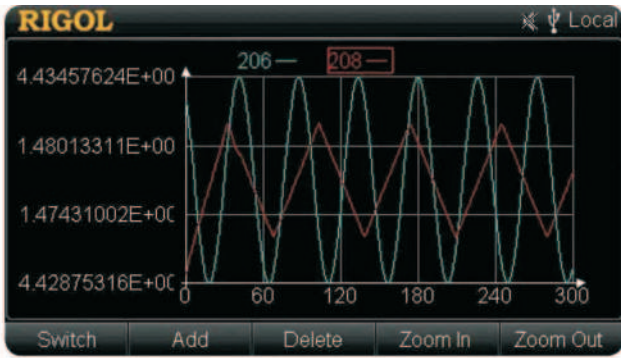


Single Channel Monitor



Multiple/All Channel Monitor

### · Multi-View Switch



Display real−time scan information and all the measurement data of the channel selected



Display real−time channel status

Draw scan data curves

Record each relay cycle on each module

Alarm Information

Error Information

· Multiple Configuration Copy Functions
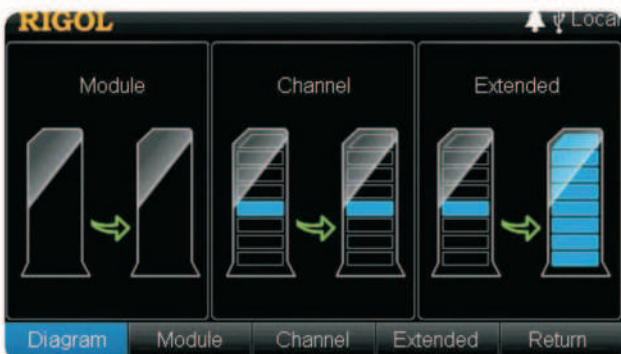
Multiple configuration copy function, can configure multiple channels conveniently and quickly

Module Copy
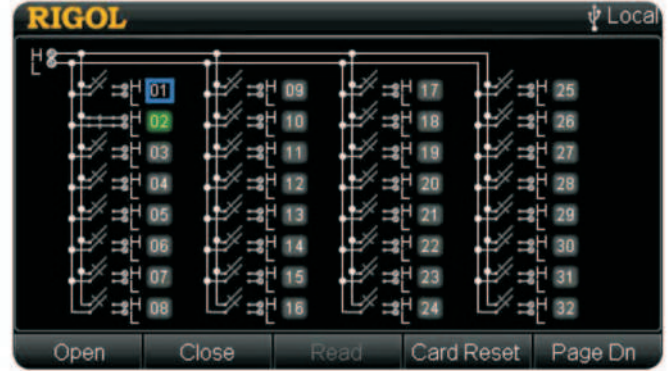
Channel Copy

Extended Copy

· To Control Each Module Separately



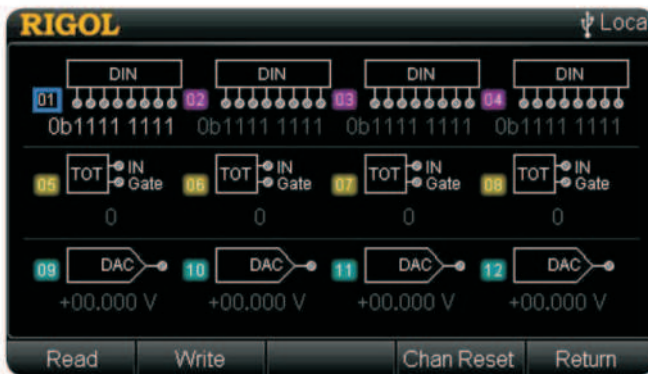To control each module separately



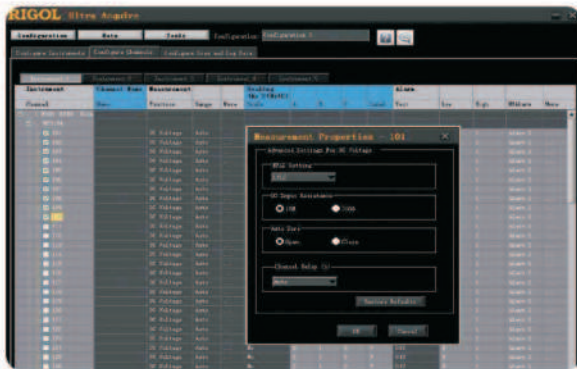MC3132 Control Interface



MC3164 Control Interface



MC3648 Control Interface
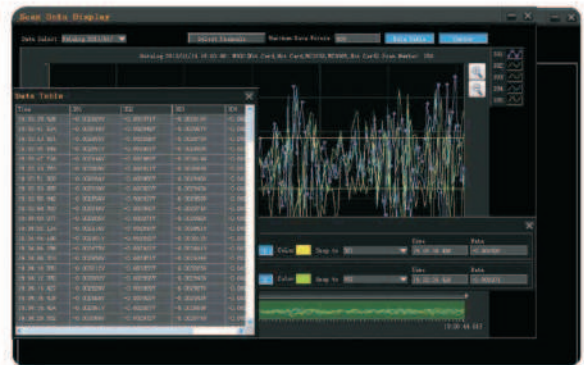


MC3534 Control Interface



MC3416 Control Interface

- **Channel Configuration of Ultra Acquire**



- **Data Analysis of Ultra Acquire**



## Modules/Terminal Block Supported by M300

| Module | Terminal Block | Description |
|---|---|---|
|  DMM-MC3065 | MC3065 doesn't need terminal block | • DMM module<br>• Used to measure the signal<br>• 6½ digits<br>• Support the following functions: DCV, ACV, DCI, ACI, 2WR, 4WR, FREQ, PERIOD, TEMP and any sensor<br>• After connecting the DMM module, make sure that the signal under test connected to the analog bus is no greater than 300 Vdc or 300 Vrms |
|  MUX20-MC3120 |  M3TB20 | • 20-channel multiplexer<br>• All 20 channels switch both HI and LO inputs<br>• Support 4-wire measurement<br>• The signal to be tested is connected through the M3TB20 terminal block<br>• Can be connected with MC3065 |
|  MUX32-MC3132 |  M3TB32 | • 32-channel multiplexer<br>• All 32 channels switch both HI and LO inputs<br>• Support 4-wire measurement<br>• The signal to be tested is connected through the M3TB32 terminal block<br>• Can be connected with MC3065 |
|  MUX64-MC3164 |  M3TB64 | • 64-channel single-ended multiplexer<br>• All 64 channels can switch HI input only<br>• Doesn't support 4-wire measurement<br>• The signal to be tested is connected through the M3TB64 terminal block<br>• Can be connected with MC3065 |
|  MIX24-MC3324 |  M3TB24 | • Mixed multiplexer with 20 voltage channels and 4 current channels<br>• All 20 voltage channels switch both HI and LO inputs<br>• 20 voltage channels support 4-wire measurement<br>• 4 current channels are used to measure DC current or AC current<br>• The signal to be tested is connected through the M3TB24 terminal block<br>• Can be connected with MC3065 |

| | | |
|---|---|---|
| ACT–MC3416 | M3TB16 | • 16–channel actuator<br>• Can connect signal to the device under test or enable external device<br>• Any of the 16 channels can switch to Normally–Open (NO) and Normally–Closed (NC) states<br>• The signal is connected through the M3TB16 terminal block |
| MFC–MC3534 | M3TB34 | • Multifunction module<br>• DIO: four 8–bit digital input/output ports<br>• TOT: four totalizer input terminals<br>• DAC: four analog output terminals<br>• The signal is connected through the M3TB34 terminal block |
| MATRIX–MC3648 | M3TB48 | • 4 × 8 two–wire matrix switch<br>• Used to connect multiple devices to multiple points on the device under test<br>• 32 two–wire cross points which can connect any combination of inputs and outputs at the same time<br>• The signal is connected through the M3TB48 terminal block |
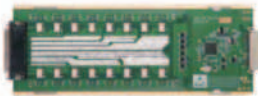
## Multiplexers Selection Guide

M300 provides five kinds of multiplexers and five kinds of external terminal blocks which are used to connect signals. These multiplexers support three types of connection modes: 1-wire mode, 2-wire mode and 4-wire mode. You can select your desired multiplexer and terminal block by referring to the following table.

| | | MC3120 | MC3132 | MC3164 | MC3324 |
|---|---|---|---|---|---|
| Number of Channels | | 20 | 32 | 64 | 20+4 |
| | | 2–wire mode or 4–wire mode | 2–wire mode or 4–wire mode | 1–wire mode | 2–wire mode or 4–wire mode |
| Scan Speed | | 60Ch/s | 60Ch/s | 60Ch/s | 60Ch/s |
| Terminal Block | | M3TB20 | M3TB32 | M3TB64 | M3TB24 |
| DC Voltage | | √ | √ | √ | √ |
| AC Voltage | | √ | √ | √ | √ |
| DC Current | | | | | √ |
| AC Current | | | | | √ |
| 2WR | | √ | √ | √ | √ |
| 4WR | | √ | √ | | √ |
| Frequency | | √ | √ | √ | √ |
| Period | | √ | √ | √ | √ |
| Temperature | TC | √ | √ | | √ |
| | RTD | √ | √ | √ | √ |
| | RTD 4W | √ | √ | | √ |
| | Thermistor | √ | √ | √ | √ |
| Any Sensor | DC Voltage | √ | √ | √ | √ |
| | DC Current | | | | √ |
| | 2WR | √ | √ | √ | √ |
| | 4WR | √ | √ | | √ |
| | Frequency | √ | √ | √ | √ |

## MC3120 20-Channel Multiplexer

- 20-channel multiplexer
- All 20 channels switch both HI and LO inputs
- Support 4-wire measurement
- The signal to be tested is connected through the M3TB20 terminal block
- Can be connected with MC3065

## MC3132 32-Channel Multiplexer

- 32-channel multiplexer
- All 32 channels switch both HI and LO inputs
- Support 4-wire measurement
- The signal to be tested is connected through the M3TB32 terminal block
- Can be connected with MC3065
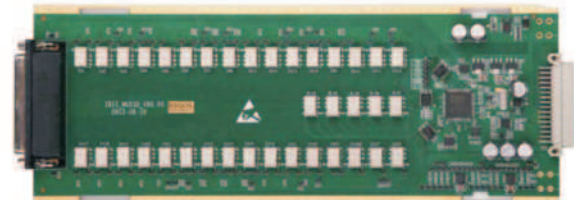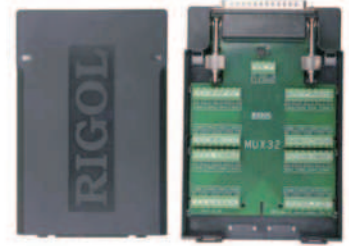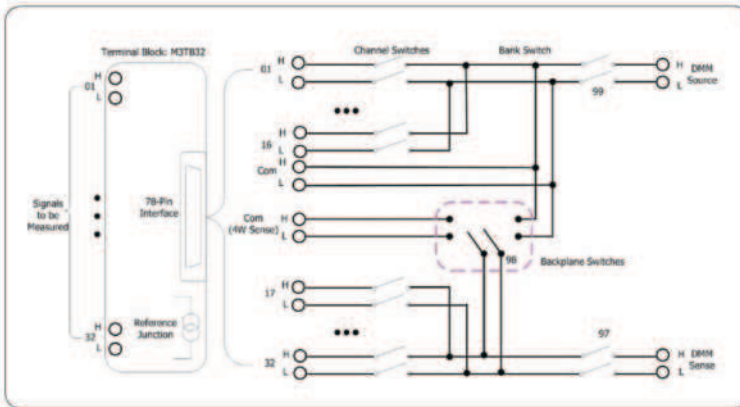


## MC3164 64-Channel Single-ended Multiplexer

- 64-channel single-ended multiplexer
- All 64 channels can switch HI input only
- Doesn't support 4-wire measurement
- The signal to be tested is connected through the M3TB64 terminal block
- Can be connected with MC3065
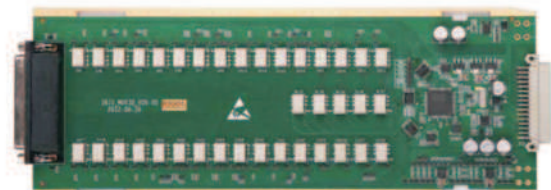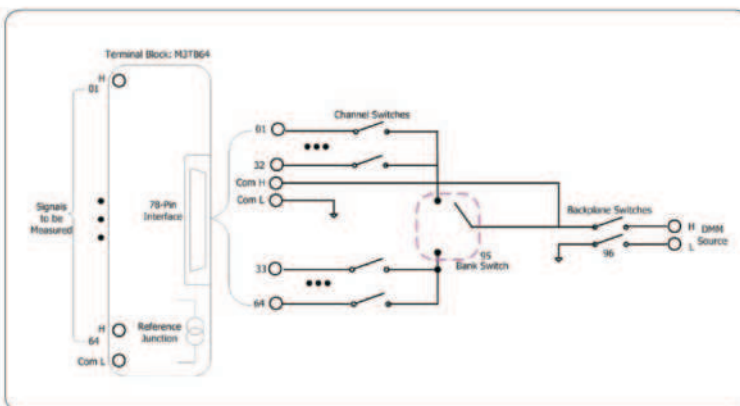
## MC3324 20-voltage-channel+4-current-channel Mixed Multiplexer

- Mixed multiplexer with 20 voltage channels and 4 current channels
- All 20 voltage channels switch both HI and LO inputs
- 20 voltage channels support 4-wire measurement
- 4 current channels are used to measure DC current or AC current
- The signal to be tested is connected through the M3TB24 terminal block
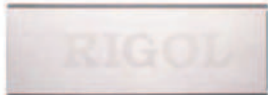- Can be connected with MC3065
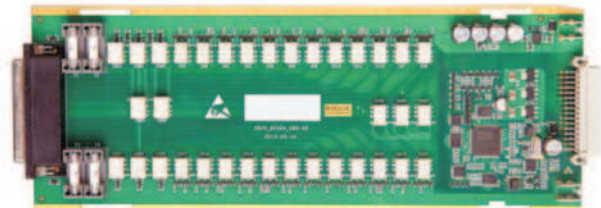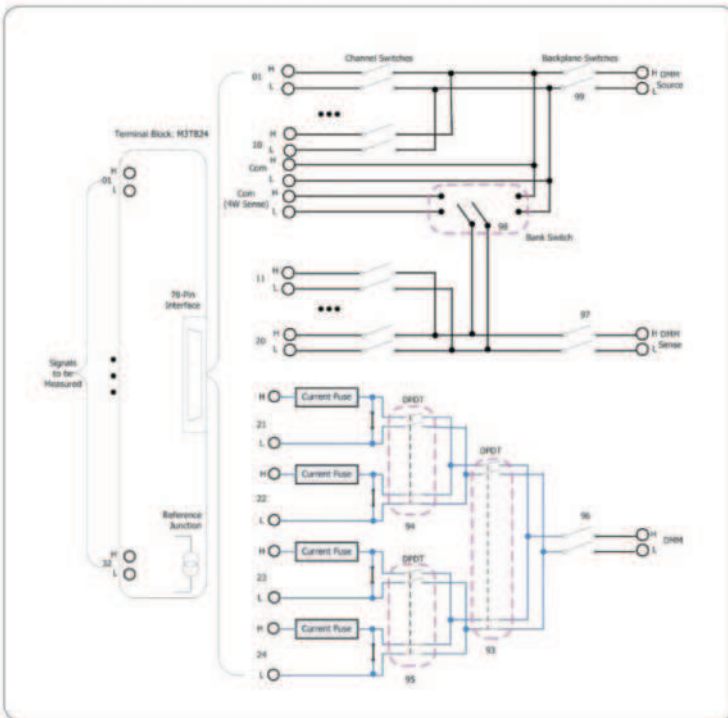


## MC3416 16-channel Actuator

- 16-channel actuator
- Can connect signal to the device under test or enable external device
- Any of the 16 channels can switch to Normally-Open (NO) and Normally-Closed (NC) states
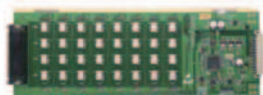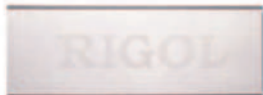- The signal is connected through the M3TB16 terminal block
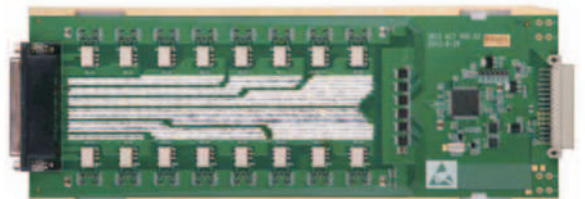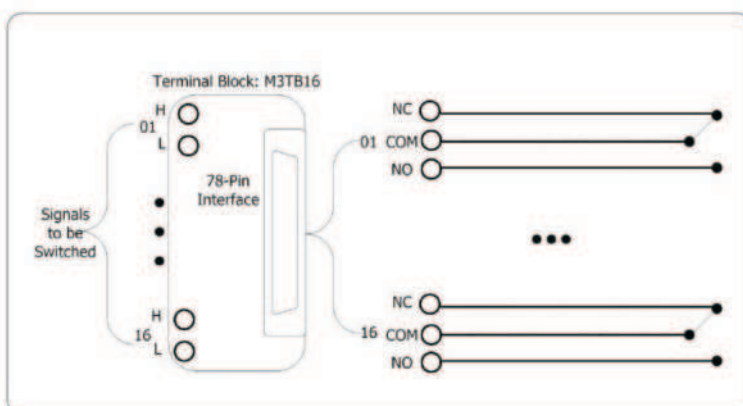
## MC3534 Multifunction Module

- Multifunction module
- DIO: four 8-bit digital input/output ports
- TOT: four totalizer input terminals
- DAC: four analog output terminals
- The signal is connected through the M3TB34 terminal block
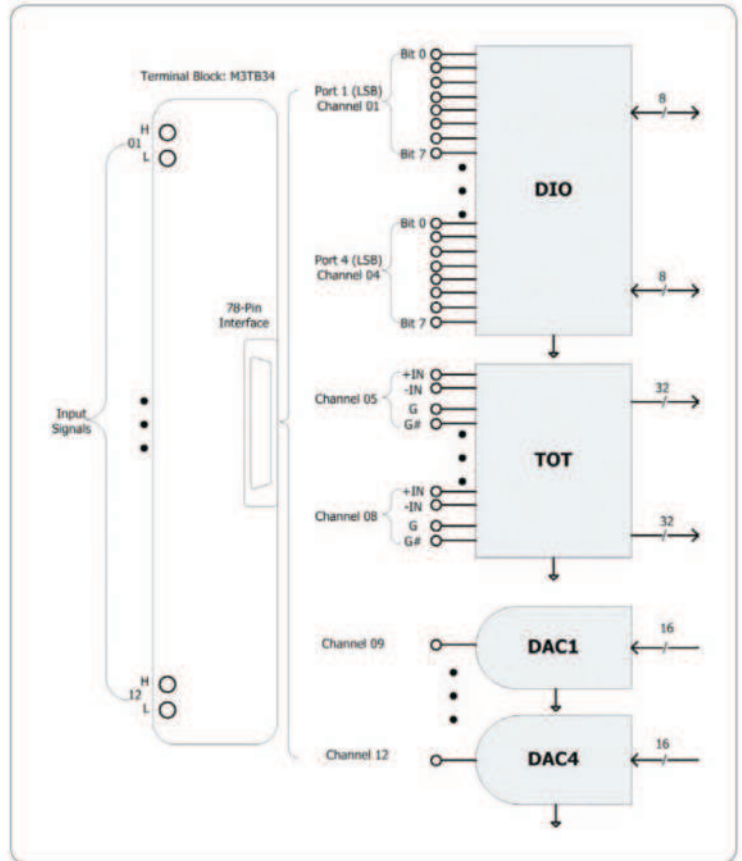


## MC3648 4×8 Matrix Switch

- 4×8 two-wire matrix switch
- Used to connect multiple devices to multiple points on the device under test
- 32 two-wire cross points which can connect any combination of inputs and outputs at the same time
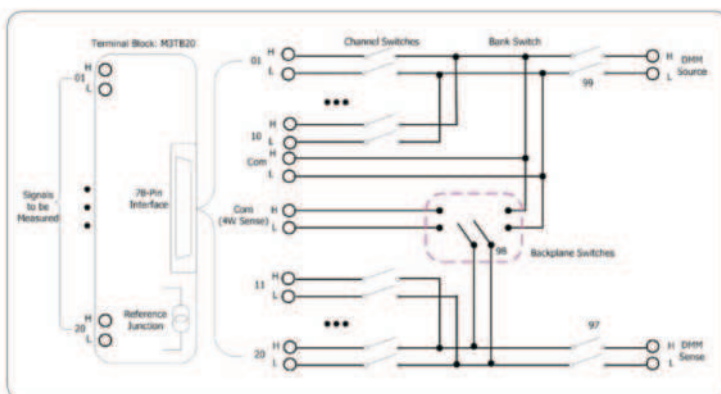- The signal is connected through the M3TB48 terminal block
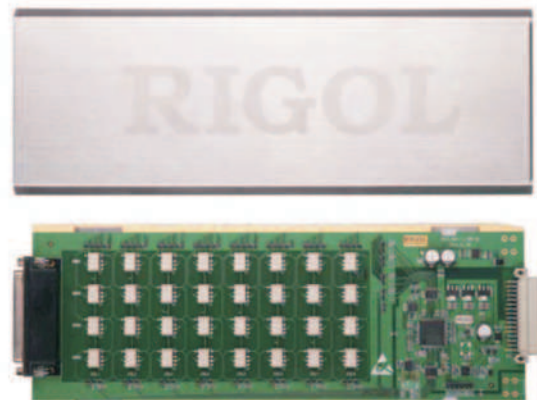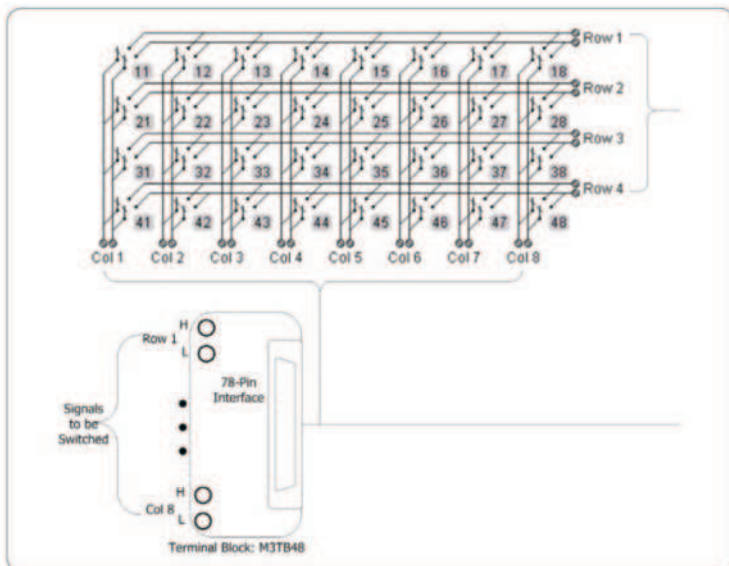
## ► Specifications

### DC Characteristics

Accuracy Specifications: ± (% of reading + % of range) [1]

| Function | Range [2] | Test Current or Load Voltage | 24 Hour [3] $T_{CAL}$℃ ±1℃ | 90 Day $T_{CAL}$℃ ±5℃ | 1 Year $T_{CAL}$℃ ±5℃ | Temperature Coefficient 0℃ to ($T_{CAL}$℃ −5℃) ($T_{CAL}$℃ +5℃) to 50℃ |
|---|---|---|---|---|---|---|
| DC Voltage | 200.0000mV | – | 0.0020+ 0.0020 | 0.0030 + 0.0025 | 0.0040 + 0.0025 | 0.0005 + 0.0005 |
| | 2.000000V | – | 0.0015 + 0.0005 | 0.0020 + 0.0006 | 0.0035 + 0.0006 | 0.0005 + 0.0001 |
| | 20.00000V | – | 0.0020 + 0.0004 | 0.0030 + 0.0005 | 0.0040 + 0.0005 | 0.0005 + 0.0001 |
| | 200.0000V | – | 0.0020 + 0.0006 | 0.0040 + 0.0006 | 0.0050 + 0.0006 | 0.0005 + 0.0001 |
| | 300.000V | – | 0.0020 + 0.0006 | 0.0040 + 0.0010 | 0.0055 + 0.0010 | 0.0005 + 0.0001 |
| DC Current | 200.0000 μ A | <0.03V | 0.010 + 0.012 | 0.040 + 0.015 | 0.050 + 0.015 | 0.0020 + 0.0030 |
| | 2.000000mA | <0.25V | 0.007 + 0.003 | 0.030 + 0.003 | 0.050 + 0.003 | 0.0020 + 0.0005 |
| | 20.00000mA | <0.07V | 0.007 + 0.012 | 0.030 + 0.015 | 0.050 + 0.015 | 0.0020 + 0.0020 |
| | 200.0000mA | <0.7V | 0.010 + 0.002 | 0.030 + 0.003 | 0.050 + 0.003 | 0.0020 + 0.0005 |
| | 1.000000A | <0.12V | 0.050 + 0.020 | 0.080 + 0.020 | 0.100 + 0.020 | 0.0050 + 0.0010 |
| Resistance [4] | 200.0000Ω | 1mA | 0.0030 + 0.0030 | 0.008 + 0.004 | 0.010 + 0.004 | 0.0006 + 0.0005 |
| | 2.000000kΩ | 1mA | 0.0020 + 0.0005 | 0.008 + 0.001 | 0.010 + 0.001 | 0.0006 + 0.0001 |
| | 20.00000kΩ | 100 μ A | 0.0020 + 0.0005 | 0.008 + 0.001 | 0.010 + 0.001 | 0.0006 + 0.0001 |
| | 200.0000kΩ | 10 μ A | 0.0020 + 0.0005 | 0.008 + 0.001 | 0.010 + 0.001 | 0.0006 + 0.0001 |
| | 1.000000MΩ | 2 μ A | 0.002 + 0.001 | 0.010 + 0.001 | 0.012 + 0.001 | 0.0010 + 0.0002 |
| | 10.00000MΩ | 200nA | 0.015 + 0.001 | 0.030 + 0.001 | 0.040 + 0.001 | 0.0030 + 0.0004 |
| | 100.0000MΩ | 200nA || 10MΩ | 0.300 + 0.010 | 0.800 + 0.010 | 0.800 + 0.010 | 0.1500 + 0.0002 |

NOTE: [1] Specifications are for 90–minute warm–up and 100 PLC integration time.
[2] 10% overrange on all ranges.
[3] Relative to calibration standards.
[4]Specifications are for 4–wire resistance measurement. Add 3Ω additional error in 2–wire resistance measurement.

### Measuring Characteristics

| DC Voltage | |
|---|---|
| Input Impedance | 200mV, 2V, 20V ranges: 10MΩ or >10GΩ (For these ranges, input beyond ±26 V are clamped through 106 kΩ) |
| | 200V and 300V ranges: 10MΩ ±1% |
| Input Protection | 300V |
| Input Offset Current | 50pA, at 25℃ , typical |
| CMRR (common mode rejection ratio) | 140 dB for 1 kΩ unbalanced resistance in LO lead, ±300 VDC peak maximum. |
| **Resistance** | |
| Measurement Method | 4–wire or 2–wire resistance Current source referenced to LO input |
| Open–circuit Voltage | Limited to <10 V |
| Max. Lead Resistance (4–wire) | 10% of range per lead for 200 Ω and 2 kΩ ranges, 1 kΩ per lead on all other ranges |
| Input Protection | 300V on all ranges |
| Offset Compensation | Available on 200 Ω, 2 kΩ and 20 kΩ ranges. |
| **DC Current** | |
| Shunt Resistor | 100 Ω for 200 uA, 2 mA |
| | 1 Ω for 20 mA , 200 mA |
| | 0.1 Ω for 1 A |

**Auto Zero OFF Operation (typical value)**

Following instrument warm–up at the environment temperature ±1℃ and <5 minutes, add 0.0001 % range + 2 uV error for DCV and 2 mΩ error for resistance.

**Settling Considerations**

Reading settling times are affected by source impedance, cable dielectric characteristics and input signal changes. The default measurement delay can ensure the correctness of the first reading for most measurements.

**Measurement Considerations**

Teflon or other high–impedance, low–dielectric absorption wire insulation is recommended for these measurements.

## AC Characteristics

Accuracy Specifications: ± (% of reading + % of range) [1]

| Function | Range[2] | Frequency Range | 24 Hour[3] $T_{CAL}$°C ±1°C | 90 Day $T_{CAL}$°C ±5°C | 1 Year $T_{CAL}$°C ±5°C | Temperature Coefficient 0°C to ($T_{CAL}$°C −5°C) ($T_{CAL}$°C +5°C) to 50°C |
|---|---|---|---|---|---|---|
| True RMS AC Voltage[4] | 200.0000mV | 3Hz– 5Hz | 1.00 + 0.03 | 1.00 + 0.04 | 1.00 + 0.04 | 0.100 + 0.004 |
| | | 5Hz–10Hz | 0.35 + 0.03 | 0.35 + 0.04 | 0.35 + 0.04 | 0.035 + 0.004 |
| | | 10Hz–20kHz | 0.04 + 0.03 | 0.05 + 0.04 | 0.06 + 0.04 | 0.005 + 0.004 |
| | | 20kHz–50kHz | 0.10 + 0.05 | 0.11 + 0.05 | 0.12 + 0.05 | 0.011 + 0.005 |
| | | 50kHz–100kHz | 0.55 + 0.08 | 0.60 + 0.08 | 0.60 + 0.08 | 0.060 + 0.008 |
| | | 100kHz– 300kHz | 4.00 + 0.50 | 4.00 + 0.50 | 4.00 + 0.50 | 0.20 + 0.02 |
| | 2.000000V | 3Hz–5Hz | 1.00 + 0.02 | 1.00 + 0.03 | 1.00 + 0.03 | 0.100 + 0.003 |
| | | 5Hz–10Hz | 0.35 + 0.02 | 0.35 + 0.03 | 0.35 + 0.03 | 0.035 + 0.003 |
| | | 10Hz–20kHz | 0.04 + 0.02 | 0.05 + 0.03 | 0.06 + 0.03 | 0.005 + 0.003 |
| | | 20kHz–50kHz | 0.10 + 0.04 | 0.11 + 0.05 | 0.12 + 0.05 | 0.011 + 0.005 |
| | | 50kHz–100kHz | 0.55 + 0.08 | 0.60 + 0.08 | 0.60 + 0.08 | 0.060 + 0.008 |
| | | 100kHz–300kHz | 4.00 + 0.50 | 4.00 + 0.50 | 4.00 + 0.50 | 0.20 + 0.02 |
| | 20.00000V | 3Hz–5Hz | 1.00 + 0.03 | 1.00 + 0.04 | 1.00 + 0.04 | 0.100 + 0.004 |
| | | 5Hz–10Hz | 0.35 + 0.03 | 0.35 + 0.04 | 0.35 + 0.04 | 0.035 + 0.004 |
| | | 10Hz–20kHz | 0.04 + 0.04 | 0.07 + 0.04 | 0.08 + 0.04 | 0.008 + 0.004 |
| | | 20kHz– 50kHz | 0.10 + 0.05 | 0.12 + 0.05 | 0.15 + 0.05 | 0.012 + 0.005 |
| | | 50kHz–100kHz | 0.55 + 0.08 | 0.60 + 0.08 | 0.60 + 0.08 | 0.060 + 0.008 |
| | | 100kHz–300kHz | 4.00 + 0.50 | 4.00 + 0.50 | 4.00 + 0.50 | 0.20 + 0.02 |
| | 200.0000V | 3Hz–5Hz | 1.00 + 0.02 | 1.00 + 0.03 | 1.00 + 0.03 | 0.100 + 0.003 |
| | | 5Hz–10Hz | 0.35 + 0.02 | 0.35 + 0.03 | 0.35 + 0.03 | 0.035 + 0.003 |
| | | 10Hz–20kHz | 0.04 + 0.02 | 0.07 + 0.03 | 0.08 + 0.03 | 0.008 + 0.003 |
| | | 20kHz–50kHz | 0.10 + 0.04 | 0.12 + 0.05 | 0.15 + 0.05 | 0.012 + 0.005 |
| | | 50kHz–100kHz | 0.55 + 0.08 | 0.60 + 0.08 | 0.60 + 0.08 | 0.060 + 0.008 |
| | | 100kHz–300kHz | 4.0 + 0.50 | 4.0 + 0.50 | 4.0 + 0.50 | 0.20 + 0.02 |
| | 300.000V | 3Hz–5Hz | 1.00 + 0.02 | 1.00 + 0.03 | 1.00 + 0.03 | 0.100 + 0.003 |
| | | 5Hz–10Hz | 0.35 + 0.02 | 0.35 + 0.03 | 0.35 + 0.03 | 0.035 + 0.003 |
| | | 10Hz–20kHz | 0.04 + 0.02 | 0.07 + 0.03 | 0.08 + 0.03 | 0.008 + 0.003 |
| | | 20kHz–50kHz | 0.10 + 0.04 | 0.12 + 0.05 | 0.15 + 0.05 | 0.012 + 0.005 |
| | | 50kHz–100kHz | 0.55 + 0.08 | 0.60 + 0.08 | 0.60 + 0.08 | 0.060 + 0.008 |
| | | 100kHz–300kHz | 4.0 + 0.50 | 4.0 + 0.50 | 4.0 + 0.50 | 0.20 + 0.02 |
| True RMS AC Current[5] | 200.0000 µ A | 3Hz–5Hz | 1.10 + 0.06 | 1.10 + 0.06 | 1.10 + 0.06 | 0.200 + 0.006 |
| | | 5Hz–10Hz | 0.35 + 0.06 | 0.35 + 0.06 | 0.35 + 0.06 | 0.100 + 0.006 |
| | | 10Hz–5kHz | 0.15 + 0.06 | 0.15 + 0.06 | 0.15 + 0.06 | 0.015 + 0.006 |
| | | 5kHz–10kHz | 0.35 + 0.70 | 0.35 + 0.70 | 0.35 + 0.70 | 0.030 + 0.006 |
| | 2.000000mA | 3Hz–5Hz | 1.00 + 0.04 | 1.00 + 0.04 | 1.00 + 0.04 | 0.100 + 0.006 |
| | | 5Hz–10Hz | 0.30 + 0.04 | 0.30 + 0.04 | 0.30 + 0.04 | 0.035 + 0.006 |
| | | 10Hz–5kHz | 0.12 + 0.04 | 0.12 + 0.04 | 0.12 + 0.04 | 0.015 + 0.006 |
| | | 5kHz–10kHz | 0.20 + 0.25 | 0.20 + 0.25 | 0.20 + 0.25 | 0.030 + 0.006 |
| | 20.00000mA | 3Hz–5Hz | 1.10 + 0.06 | 1.10 + 0.06 | 1.10 + 0.06 | 0.200 + 0.006 |
| | | 5Hz–10Hz | 0.35 + 0.06 | 0.35 + 0.06 | 0.35 + 0.06 | 0.100 + 0.006 |
| | | 10Hz–5kHz | 0.15 + 0.06 | 0.15 + 0.06 | 0.15+ 0.06 | 0.015 + 0.006 |
| | | 5kHz–10kHz | 0.35 + 0.70 | 0.35 + 0.70 | 0.35 + 0.70 | 0.030 + 0.006 |
| | 200.0000mA | 3Hz–5Hz | 1.00 + 0.04 | 1.00 + 0.04 | 1.00 + 0.04 | 0.100 + 0.006 |
| | | 5Hz–10Hz | 0.30 + 0.04 | 0.30 + 0.04 | 0.30 + 0.04 | 0.035 + 0.006 |
| | | 10Hz–5kHz | 0.10 + 0.04 | 0.10 + 0.04 | 0.10 + 0.04 | 0.015 + 0.006 |
| | | 5kHz–10kHz | 0.20 + 0.25 | 0.20 + 0.25 | 0.20 + 0.25 | 0.030 + 0.006 |
| | 1.000000A | 3Hz–5Hz | 1.10 + 0.06 | 1.10 + 0.06 | 1.10 + 0.06 | 0.100 + 0.006 |
| | | 5Hz–10Hz | 0.35 + 0.06 | 0.35 + 0.06 | 0.35 + 0.06 | 0.035 + 0.006 |
| | | 10Hz–5kHz | 0.15 + 0.06 | 0.15 + 0.06 | 0.15 + 0.06 | 0.015 + 0.006 |
| | | 5kHz–10kHz | 0.35 + 0.70 | 0.35 + 0.70 | 0.35 + 0.70 | 0.030 + 0.006 |
| | | 5Hz–10Hz | 0.35 + 0.08 | 0.35 + 0.10 | 0.35 + 0.10 | 0.035 + 0.008 |
| | | 10Hz–5kHz | 0.15 + 0.08 | 0.15 + 0.10 | 0.15 + 0.10 | 0.015 + 0.008 |

NOTE: [1] Specifications are for 90–minute warm–up, slow ac filter and sine wave input.

[2] 10% overrange on all ranges.

[3] Relative to calibration standards.

[4] Specifications are for sine wave input >5% of range. For inputs from 1% to 5% of range and <50 kHz, add 0.1% of range additional error. For 50 kHz to 100 kHz, add 0.13% of range.

[5] Specifications are for sine wave input >5% of range. For inputs from 1% to 5% of range, add 0.1% of range additional error. Specifications are typical values for 200 uA, 2 mA and 1 A ranges when frequency is >1 kHz.

## Measuring Characteristics

| True RMS AC Voltage | |
|---|---|
| Measurement Method | AC–coupled True–RMS –– measure the ac component of input with up to 300 V DC bias on any range. |
| Crest Factor | ≤ 5 at full range |
| Input Impedance | 1 MΩ ± 2%, in parallel with <150 pF capacitance on any range |
| Input Protection | 300 V rms on all ranges |
| AC Filter Bandwidth | Slow: 3 Hz – 300 kHz |
| | Medium: 20 Hz – 300 kHz |
| | Fast: 200 Hz – 300 kHz |
| CMRR (common mode rejection ratio) | 70 dB, for the 1 kΩ unbalance in LO lead, <60 Hz common mode signal frequency, ±300 VDC peak maximum. |
| True RMS AC Current | |
| Measurement Method | Direct coupled to the fuse and shunt; AC–coupled True RMS measurement (measure the AC component). |
| Crest Factor | ≤ 3 at full range |
| Max. Input | DC + AC current peak value <300% of range. Current with DC current component <1 A rms. |
| Shunt Resistor | 100 Ω for 200 uA, 2 mA |
| | 1 Ω for 20 mA , 200 mA |
| | 0.1 Ω for 1 A |

**Settling Time Considerations**

The default measurement delay of the multimeter can ensure the correctness of the first readings of most of the measurements. Make sure the RC circuit of input terminal has been fully settled (about 1 s) before accurate measurement.

## Frequency and Period Characteristics

Accuracy Specifications: ± (% of reading[1][2]

| Function | Range | Frequency Range | 24 Hour[3] $T_{CAL}$°C ±1°C | 90 Day $T_{CAL}$°C ±5°C | 1 Year $T_{CAL}$°C ±5°C | Temperature Coefficient 0°C to ( $T_{CAL}$°C –5°C ) ( $T_{CAL}$°C +5°C ) to 50°C |
|---|---|---|---|---|---|---|
| Frequency, Period | 200mV–300V | 3 Hz–5 Hz | 0.07 | 0.07 | 0.07 | 0.005 |
| | | 5 Hz–10 Hz | 0.04 | 0.04 | 0.04 | 0.005 |
| | | 10 Hz–40 Hz | 0.02 | 0.02 | 0.02 | 0.001 |
| | | 40 Hz–300 kHz | 0.005 | 0.006 | 0.007 | 0.001 |
| | | 300 kHz–1 MHz | 0.005 | 0.006 | 0.007 | 0.001 |

Additional Low Frequency Errors: (% of reading)

| Frequency | Gate Time (Resolution) | | | |
|---|---|---|---|---|
| | 1s ( 0.1ppm ) | 0.1s ( 1ppm ) | 0.01s ( 10ppm ) | 0.001s ( 100ppm ) |
| 3 Hz–5Hz | 0 | 0.12 | 0.12 | 0.12 |
| 5 Hz–10Hz | 0 | 0.17 | 0.17 | 0.17 |
| 10 Hz–40Hz | 0 | 0.20 | 0.20 | 0.20 |
| 40 Hz–100Hz | 0 | 0.06 | 0.21 | 0.21 |
| 100 Hz–300Hz | 0 | 0.03 | 0.21 | 0.21 |
| 300 Hz–1 kHz | 0 | 0.01 | 0.07 | 0.07 |
| >1kHz | 0 | 0 | 0.02 | 0.02 |

NOTE: [1] Specifications are for 90 minutes warm–up and 1 s gate time.

[2] For frequency ≤ 300 kHz, the specification is for AC input voltage of 10% to 110% of range. For frequency >300 kHz, the specification is for AC input voltage of 20% to 110% of range. The maximum input is limited to 750 Vrms or 8 x 10⁷ Volts–Hz (whichever is less). 200 mV range is full range input or input that is larger than the full range. For 20 mV to 200 mV inputs, multiply % of reading error by 10.

[3] Relative to calibration standards.

## Measuring Characteristics

| Frequency and Period | |
|---|---|
| Measurement Method | Reciprocal–counting technique, AC–coupled input using the AC voltage function. |
| Input Impedance | 1 MΩ ± 2%, in parallel with <150 pF capacitance on any range |
| Input Protection | 300 Vrms on all ranges |

**Measurement Considerations**

All frequency counters are susceptible to error when measuring low–voltage, low–frequency signals. Shielding inputs from external noise pickup is critical for minimizing measurement errors.

**Settling Considerations**

Errors will occur when attempting to measure the frequency or period of an input following a dc offset voltage change. The input blocking RC time constant must be allowed to fully settle (about 1 s) before the most accurate measurements are possible.

## Temperature Characteristics

Accuracy Specifications [1]

| Function | Probe Type | Type | Optimum Range | 1 Year $T_{CAL}°C \pm 5°C$ | Temperature Coefficient 0°C to ($T_{CAL}°C -5°C$) ($T_{CAL}°C +5°C$) to 50°C |
|---|---|---|---|---|---|
| Temperature | RTD [2] (R0 is within 49 Ω and 2.1 kΩ) | α =0.00385 | −200°C − 660°C | 0.16°C | 0.01°C |
| | | α =0.00389 | −200°C − 660°C | 0.17°C | 0.01°C |
| | | α =0.00391 | −200°C − 660°C | 0.14°C | 0.01°C |
| | | α =0.00392 | −200°C − 660°C | 0.15°C | 0.01°C |
| | Thermal Resistance | 2.2 kΩ | −40°C − 150°C | 0.08°C | 0.002°C |
| | | 3 kΩ | −40°C − 150°C | 0.08°C | 0.002°C |
| | | 5 kΩ | −40°C − 150°C | 0.08°C | 0.002°C |
| | | 10 kΩ | −40°C − 150°C | 0.08°C | 0.002°C |
| | | 30 kΩ | −40°C − 150°C | 0.08°C | 0.002°C |
| | Thermocouple [3] | B | 0°C − 1820°C | 0.76°C | 0.14°C |
| | | E | −270°C − 1000°C | 0.5°C | 0.02°C |
| | | J | −210°C − 1200°C | 0.5°C | 0.02°C |
| | | K | −270°C − 1372°C | 0.5°C | 0.03°C |
| | | N | −270°C − 1300°C | 0.5°C | 0.04°C |
| | | R | −50°C − 1768.1°C | 0.5°C | 0.09°C |
| | | S | −50°C − 1768.1°C | 0.6°C | 0.11°C |
| | | T | −270°C − 400°C | 0.5°C | 0.03°C |

NOTE: [1] Specifications are for 90 minutes warm−up. Probe error excluded.
[2] Specification is for 4WR resistance measurement.
[3] Relative to cold junction temperature, accuracy is based on ITS−90. Built−in cold junction temperature refers to the temperature of the connector inside the terminal block and its accuracy is ±2.5 °C .

## Measuring Characteristics

| Thermocouple | |
|---|---|
| Conversion | ITS−90 software compensation |
| Reference Junction Type | Internal, Fixed, or External |
| T/C Check | Selectable per channel. When the channel resistance is >5kΩ, it is considered as Open. |
| RTD | |
| Alpha | = 0.00385 (DIN/IEC 751): using ITS−90 software compensation; = 0.00389, 0.00391 or 0.00392: using IPTS−68 software compensation |
| Thermistor | |
| | 44004, 44007, 44006 series |

## Measurement Considerations

The built−in cold junction temperature tracks the temperature inside the terminal box. The change of temperature in the terminal box might cause additional error. When using the built−in cold junction compensation, connect the sensor terminal of the thermocouple to the terminal box and warm it up for more than 3 minutes to minimize the error.

## Module Specifications

MC3120/MC3132/MC3164/MC3324/MC3416/MC3648

| General | Multiplexer | | | | Actuator | Matrix |
|---|---|---|---|---|---|---|
| | MC3120 | MC3132 | MC3164 | MC3324 | MC3416 | MC3648 |
| Number of Channels | 20 | 32 | 64 | 20 Voltage+4 Current | 16 | 4 × 8 |
| | 2–wire mode or 4–wire mode[1] | 2–wire mode or 4–wire mode[1] | 1–wire mode[2] | 2–wire mode or 4–wire mode[3] | SPDT | 2–wire mode |
| Connect to DMM Module? | Yes | Yes | Yes | Yes | No | No |
| Scanning Speed[4] | 60Ch/s | 60Ch/s | 60Ch/s | 60Ch/s | —— | —— |
| Open/Close Speed | 200Ch/s | 200Ch/s | 200Ch/s | 200Ch/s | 200Ch/s | 200Ch/s |
| Maximum Input | | | | | | |
| Voltage (DC, AC rms) | 300Vrms | 300Vrms | 300Vrms | 300Vrms | 300Vrms | 300Vrms |
| Current (DC, AC rms) | 1Arms | 1Arms | 1Arms | 1Arms | 2Arms | 1Arms |
| Power (W, VA) | 50VA | 50VA | 50VA | 50VA | 60VA | 50VA |
| Isolation (ch–ch, ch–earth) (DC, AC rms) | 300Vrms | 300Vrms | 300Vrms | 300Vrms | 300Vrms | 300Vrms |
| DC Characteristics | | | | | | |
| Offset Voltage | 5uV | 5uV | 5uV | 5uV | <3uV | 5uV |
| Initial Closed Channel Resistance | <1Ω | <1Ω | <1Ω | <1Ω | <0.1Ω | <1Ω |
| Isolation (ch–ch, ch–earth) | >10GΩ | >10GΩ | >10GΩ | >10GΩ | >10GΩ | >10GΩ |
| AC Characteristics | | | | | | |
| Bandwidth | 1MHz | 1MHz | 1MHz | 1MHz | 1MHz | 1MHz |
| Ch–Ch Cross Talk (dB) [5] 1MHz | −45 | −45 | −18[6] | −45 | − 15 | −18 |
| Capacitance HI–LO | 100pF | 100pF | 100pF | 100pF | <500pF | 100pF |
| Capacitance LO–Earth | 200pF | 200pF | 200pF | 200pF | <200pF | 200pF |
| Volt–Hertz Limit | $10^8$ | $10^8$ | $10^8$ | $10^8$ | $10^8$ | $10^8$ |
| Other | | | | | | |
| T/C Cold Junction Accuracy (Typical) | 0.8℃ | 0.8℃ | 0.8℃ [7] | 0.8℃ | —— | —— |
| Switch Life (No Load) (Typical) | 100M | 100M | 100M | 100M | 100M | 100M |
| Switch Life (Rated Load) (Typical) [8] | 100K | 100K | 100K | 100K | 100K | 100K |
| Operating Temperature | 0℃ – 55℃ | 0℃ – 55℃ | 0℃ – 55℃ | 0℃ – 55℃ | 0℃ – 55℃ | 0℃ – 55℃ |
| Storage Temperature | −20℃ – 70℃ | −20℃ – 70℃ | −20℃ – 70℃ | −20℃ – 70℃ | −20℃ – 70℃ | −20℃ – 70℃ |
| Humidity (non–condensing) | 40℃ / 80% RH | 40℃ / 80% RH | 40℃ / 80% RH | 40℃ / 80% RH | 40℃ / 80% RH | 40℃ / 80% RH |

NOTE: [1] 20 channel multiplexer can be used as 20 2–wire or 10 4–wire measurement channels and 32 channel multiplexer can be used as 32 2–wire or 16 4–wire measurement channels.
[2] 64 channel multiplexer share a Common Low for two banks of 32 channels.
[3] 24 Channel multiplexer can be configured as 20 2–wire voltage channels or 10 4–wire voltage channels in addition to the 4 current channels.
[4] Integration time: 0.02PLC, channel delay: 0, auto zero: off, alarm: off, scaling: off, data to internal memory (disconnect the communication of the LAN, USB, GPIB or RS232 interface), the results are measured under the DCV function.
[5] 50Ω load.
[6] Isolation within banks is −40dB.
[7] Specifications are for the LO setting and not the temperature of the cold terminal.
[8] Applies to resistive loads only.

**MC3534**

## Digital Input/Output (DIO)

| Port 1,2,3,4 | 8–bit, input or output, non–isolated | | | | |
|---|---|---|---|---|---|
| Type | Vin(L) | Vin(H) | Vout(L) | Vout(H) | Vin(H) Max |
| TTL | <0.8V | >2.0V | <0.2V@$I_{out}$=–500mA | >4.8V@$I_{out}$=1mA | <42V with external open drain pull–up |
| 5V CMOS | <1.5V | >3.5V | <0.2V@$I_{out}$=–500mA | >4.8V@$I_{out}$=1mA | |
| 3.3V CMOS | <1.0V | >2.3V | <0.2V@$I_{out}$=–500mA | >3.15V@$I_{out}$=1mA | |
| 2.5V CMOS | <0.75V | >1.75V | <0.2V@$I_{out}$=–500mA | >2.35V@$I_{out}$=1mA | |
| User defined | Threshold–0.3V | Threshold+0.3V | <0.2V@$I_{out}$=–500mA | >(Level–0.2V)@$I_{out}$=1mA | |
| Alarming | Match or mismatch, maskable | | | | Match or mismatch, maskable |
| Speed | 4ms (Max) alarm sampling | | | | 4ms (Max) alarm sampling |
| Latency | 5ms | | | | 5ms |
| Read/Write Speed | 100/s | | | | 100/s |

## Totalizer Input (TOT)

| | High Speed (TOT1,TOT2) | Normal Speed (TOT3,TOT4) |
|---|---|---|
| Maximum Count | $2^{32}$–1 | $2^{32}$–1 |
| Totalizer Input | 10MHz (max), rising or falling edge, programmable | 100kHz (max), rising or falling edge, programmable |
| Signal Level | CMOS 3.3V,5V tolerable | 1Vp–p(min),42Vpk(max), Vcm=–12V~+12V |
| Threshold | Fixed at CMOS 3.3V | –12V~+12V, Programmable |
| Gated Input | CMOS 3.3V–Hi, CMOS 3.3V–Lo or none, 5V tolerance | CMOS 3.3V–Hi, CMOS 3.3V–Lo or none, 5V tolerance |
| Count Reset | Manual or Read + Reset | Manual or Read + Reset |
| Read Speed | 100/s | 100/s |

## Analog Voltage Output (DAC)

| DAC 1,2,3,4 | ± 12V, non–isolated (earth referenced) |
|---|---|
| Resolution | 1mV |
| Iout | 10mA max |
| Setting Time | 1ms to 0.01 % of output |
| Accuracy 1 year ± 5℃ | ±( % of output + mV) 0.25%+20mV |
| Temp Coefficient | ± (0.015%+1mV)/℃ |

## General Specifications

| Display | 4.3 inches |
|---|---|
| Power Supply | AC 100V – 120V, 45Hz – 440Hz<br>AC 200V – 240V, 45Hz – 66Hz<br>Detect the power frequency automatically at power–on, 400 Hz defaults to 50 Hz |
| Power Consumption | 25 VA Max |
| Working Environment | Full accuracy for 0℃ to 50℃<br>Full accuracy to 80% R.H. at 40℃ Non–coagulation |
| Storage Temperature | –40℃ to 70℃ |
| Operation Altitude | Up to 2000 meters |
| Safety | IEC 61010–1; EN 61010–1; UL 61010–1; CAN/CSA–C22.2 No. 61010–1<br>Measurement CAT I 300V<br>Pollution Degree 2 |
| EMC | EN 61326–1 |
| Weight | About 5.7 kg (without package) |
| Dimension | (height × width × length): 159.0mm × 239.0mm × 373.4mm |
| Remote Interface | GPIB, 10/100Mbit LAN, USB 2.0 Full Speed Device & Host (support USB storage device), RS232 |
| Programming Language | SCPI |
| LXI Compatibility | LXI Core 2011 Device，Version 1.4 |
| Warm–up Time | 90 minutes |

## ▶ Ordering Information

| | Description | Ordering No. |
|---|---|---|
| **Mainframe** | Data Acquisition/Switch System | M300 |
| | Data Acquisition/Switch System + DMM Module | M301 |
| | Data Acquisition/Switch System + DMM Module+MC3120 20-Channel Multiplexer + M3TB20 Terminal Block | M302 |
| **Standard Accessories** | Power Cord Conforming to the Standard of the Country | - |
| | USB Cable | CB-USBA-USBB-FF-150 |
| | Mixed-interface Separator Line | MIX-SEPARATOR |
| | M300 Series Standard Control and Data Analysis PC Software | Ultra Acquire |
| | Four Spare Fuses: 2 AC, 250 V, T3.15 A fuses 2 AC, 250 V, T250 mA fuses | - |
| | Quick Guide | - |
| | Resource CD (User's Guide and Ultra Acquire) | - |
| **Optional Accessories: Module** | DMM Module (6½ digits) | MC3065 |
| | 20-Channel Multiplexer | MC3120 |
| | 32-Channel Multiplexer | MC3132 |
| | 64-Channel Single-ended Multiplexer | MC3164 |
| | 20-Voltage-Channel+4-Current-Channel Mixed Multiplexer | MC3324 |
| | 16-Channel Actuator | MC3416 |
| | Multifunction Module | MC3534 |
| | 4×8 Matrix Switch | MC3648 |
| **Optional Accessories: Terminal block** | MC3120 Terminal Block | M3TB20 |
| | MC3132 Terminal Block | M3TB32 |
| | MC3164 Terminal Block | M3TB64 |
| | MC3324 Terminal Block | M3TB24 |
| | MC3648 Terminal Block | M3TB48 |
| | MC3534 Terminal Block | M3TB34 |
| | MC3416 Terminal Block | M3TB16 |
| **Optional Accessories** | RS232 Cable | - |
| | External Port for Analog Bus | A-BUS-EXT-PORT |
| | SMB-BNC Cables | SMB-BNC |
| | Rack Mount Kit | RM-1-M300 |
| | Rack Mount Kit for Two Instruments | RM-2-M300 |
| | M300 Series Control and Advanced Data Analysis PC Software | Ultra Acquire Pro |

Subject to Change