Rugged Precision

The MAQ®20 Industrial
Data Acquisition & Control System
2014 Product Catalog

DATAFORTH®

The Company

"Our passion at Dataforth Corporation is designing, manufacturing, and marketing the best possible data acquisition and control, signal conditioning, and data communication products. Our mission is to set new standards of product quality, performance, and customer service." **Dataforth Corporation**, with more than a quarter century of experience, is the worldwide leader in Instrument Class® Industrial Electronics – rugged, high-performance data acquisition and control, signal conditioning, and data communication products that play a vital role in maintaining the integrity of industrial automation, data acquisition, and quality assurance systems. Our products directly connect to most industrial sensors and protect valuable measurement and control signals and equipment from the dangerous and degrading effects of noise, transient power surges, internal ground loops, and other hazards present in industrial environments.

Global Service and Support

Dataforth spans the globe with more than 50 International Distributors and US Representative Companies. Our customers benefit from a team of over 130 sales people highly trained in the application of precision products for industrial markets. In addition, we have a team of application engineers in our Tucson factory ready to solve any in-depth application questions. Upon receipt of a quote or order, our Customer Service Department provides fast one-day delivery information turnaround. We maintain an ample inventory that allows small quantity orders to be shipped from stock.

Research and Development Team

A professional staff of engineering and marketing personnel identify and develop products to satisfy our customers' most stringent requirements. Dataforth's design department is composed of advanced degree engineers specializing in innovative analog and isolation circuit development, high performance mixed signal design, and software development, ensuring our customers of the highest performance products at the lowest price.

Automated Manufacturing and Test

Automated manufacturing techniques and machines are employed to produce our state-of-the-art SMT designs in optimum time and at minimum cost. All products are tested multiple times in automated test fixtures, and many undergo a 48-hour burn-in at elevated temperatures.

Quality Control

Dataforth operates under an ISO9001:2008 quality management system. Since our products are used in critical industrial data acquisition, control, and test and measurement applications, we strive to produce the highest quality, premier performance products available on the market. Zero defects and complete customer satisfaction are our goals. To further strengthen our commitment to quality, Dataforth secures certifications such as UL, CSA, ATEX, and CE.

www.dataforth.com

Utilizing the latest web development technology, our website presents visitors with an intuitive, informative layout that quickly leads them to their areas of interest. A parametric search engine efficiently locates products by model number or functional description, while an e-commerce section provides pricing information and order entry. Fully detailed product data sheets and application notes are available for download in PDF format. Visitors also can request literature, view new product release data, read our bi-monthly newsletters, get answers to technical questions, and quickly locate Distributors and Sales Representatives.

The Future

We fully understand that our ongoing success depends on satisfying our customers' requirements. Building upon our position as marketplace leader, Dataforth continues to seek out the most cost-effective emerging technologies in design and manufacturing in order to provide the highest performance quality products at the lowest price. Our recent expansion into a second building adds thousands of square feet to our manufacturing and test facilities and provides the flexibility and space for continued process-oriented growth. By intelligently observing and responding to constantly changing market forces, we ensure the continuation of our critical customer partnerships.
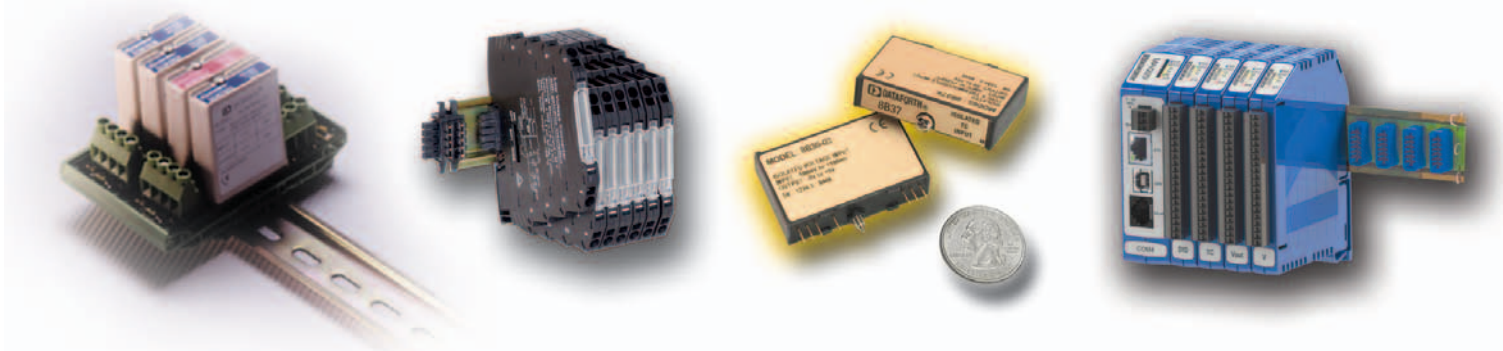
The Dataforth System Builder

Dataforth's System Builder is an innovative, interactive online feature that allows you to create your own system, module by module. Based on your stated requirements and parameters, suggestions are automatically given on which products to choose to build the most effective system. Pricing information is continuously updated, thereby enabling you to obtain the best system for your needs at the most cost-effective price.

Visit Dataforth's Full-Service Website: www.dataforth.com

Dataforth's full-service website is an easy-to-use, comprehensive source for sales, product, and applications information. The site includes:

- Fast, accurate parametric search capabilities for all Dataforth industrial signal conditioning, data acquisition, and data communication products

- Online product quote and purchase

- Online product data sheets, application notes, and user manuals

- Direct applications assistance, sales, and customer service help lines readily available

- Latest news on company operations and new products

- Comprehensive signal conditioning, data acquisition, and control tutorial

- Worldwide corporate and sales contact information
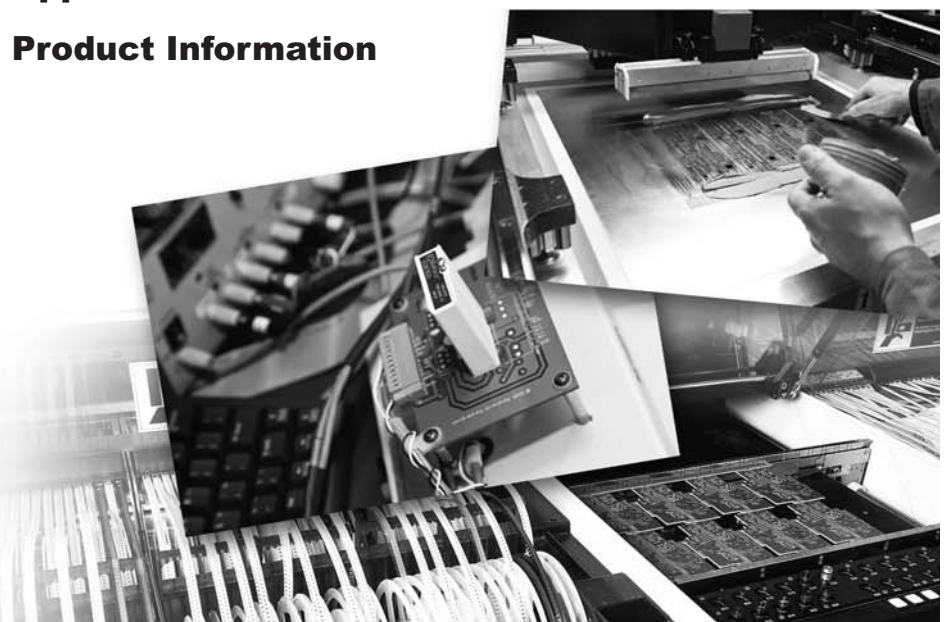
- Literature ordering center
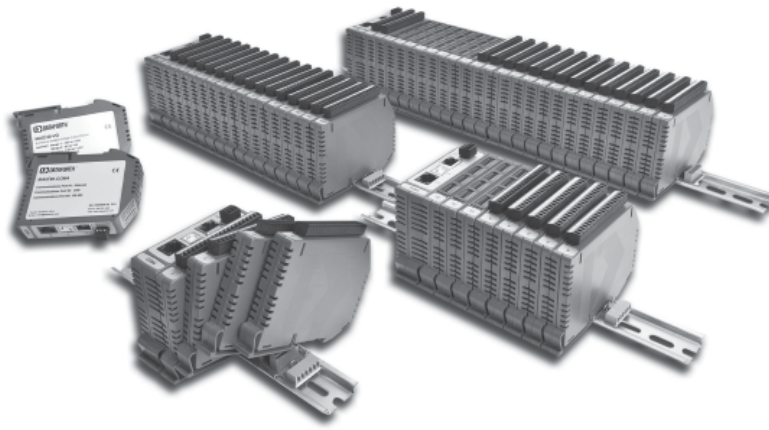
Online Help

Online Ordering

Data Sheets

Application Notes

Product Information

MAQ®20

Industrial Data Acquisition & Control System

▶ Features

- Industry's Lowest Cost per Channel
- ±0.035% Accuracy (Typical)
- 1500Vrms Channel-to-Bus Isolation
- Up to 240Vrms Continuous Field I/O Protection
- ANSI/IEEE C37.90.1 Transient Protection
- Direct Connection to Internet Option
- Graphical Control Software
  - ReDAQ® Shape for MAQ®20 Software
  - IPEmotion Software
- Advanced Features Including Integral PID Control, Alarms, Counters, Timers, PWMs, and more
  - Up to 32 PID Loops with ReDAQ® Shape Software
  - Unlimited PID Loops with IPEmotion Software
- Wide Range 7-34VDC Input Power
- –40°C to +85°C Industrial Operating Temperature
- UL/CUL Listing Pending
  (Class I, Division 2, Groups A, B, C, D)
- Heavy Industrial CE and ATEX Compliance Pending
- Manufactured per RoHS Directive 2002/95/EC

Description

The MAQ®20 Industrial Data Acquisition and Control System encompasses more than 25 years of design excellence and quality in the industrial test and measurement and control industry. This powerful, high performance, highly flexible system offers the industry's lowest cost per channel, integral PID loop control, and ±0.035% system accuracy (module dependent). It is ideal for test and measurement, factory and process automation, machine automation, military and aerospace, power and energy, environmental monitoring, and oil and gas applications. The MAQ20 family consists of DIN rail mounted, programmable, multi-channel, industrially rugged signal conditioning input and output modules and communications modules (Figure 1). Each I/O module has a 1500Vrms isolation barrier between field-side and system-side wiring, and many models offer per-channel isolation. All field wiring terminals are heavily protected against overload, accidental connection of incorrect signals, and ESD. Modules mount on the industry standard 35x7.5mm gull-wing DIN rail. A backbone mounts within the rail providing power and communication interconnections between the communications modules and each I/O module.
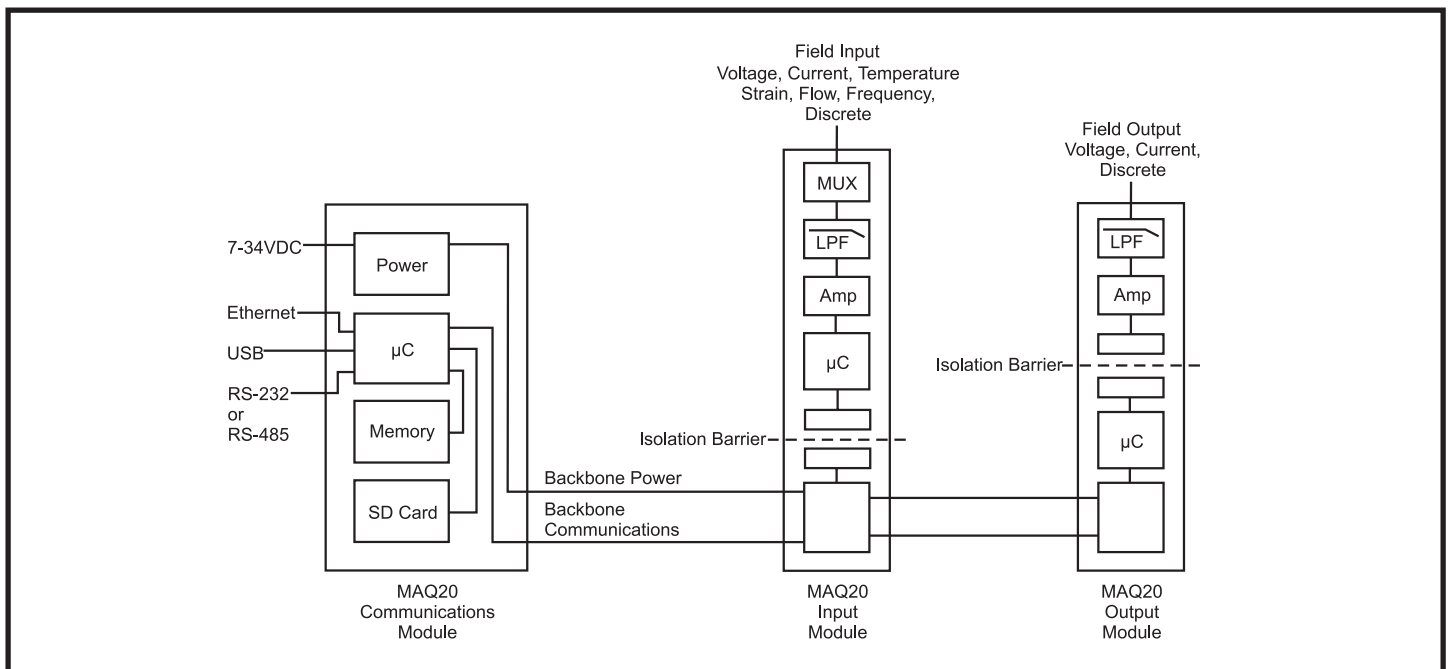

Figure 1: MAQ20 System Block Diagram

The Modules: Compact, Flexible, and Powerful

One MAQ20 communications module can interface to up to 24 I/O modules to construct a system with a maximum of 384 channels that fits within a standard 19" instrumentation rack. Processors within each module make this distributed system extremely powerful.

• **Communications Module:** Offered in Ethernet, RS-232, RS-485, and USB with host application software interfacing to the system using Modbus TCP or Modbus RTU protocol.

• **Analog Input Modules:** Interface to a wide range of standard industrial sensors and equipment and offer up to 16 channels of input, each of which can be independently configured; signal ranges are user selectable and offered in differential and single-ended configurations.

- **Voltage and Current Input Modules** offer 8-channel differential input or 16-channel single-ended input for precise measurement of voltage and current signals; all channels are individually configurable for range, alarm limits, and averaging.

- **Thermocouple Input Modules** offer 8 differential input channels, all of which are individually configurable for range, alarm limits, and averaging. Separate models are offered for interfacing to Type J, Type K, Type T and Types R and S thermocouples.

- **RTD and Potentiometer Input Modules** interface to 2-wire, 3-wire, and 4-wire sensors including five RTD types and potentiometers. Modules offer six channels, each configurable for range, alarm limits, and averaging.

- **Strain Gage Input Module**◊ connects to full, half, and quarter bridge sensors and offers four channels; each channel is configurable for range, alarm limits, averaging, bandwidth, excitation V, gain, shunt cal resistors, and sample rate.

◊ Preliminary at date of printing.
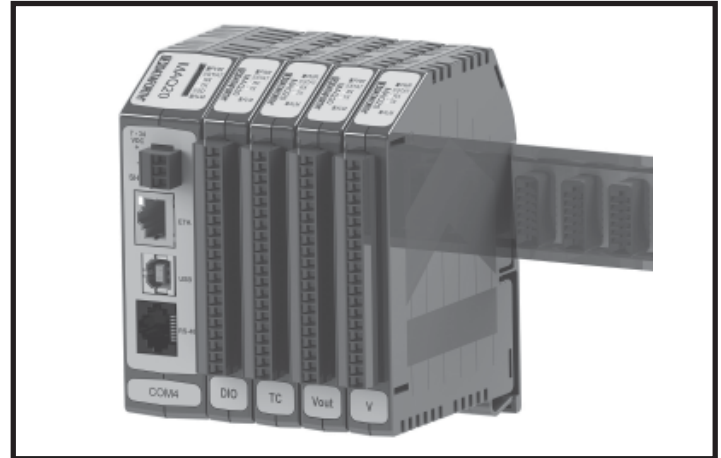 Contact factory for availability.

Figure 2: Communications Module with I/O Modules

- **Frequency Input Module**◊ accepts zero-crossing and TTL signals with frequencies of DC to 1MHz and provides a DC stimulus for contact sensors. This module has eight channels, each configurable for range and alarm limits.

• **Analog Output Modules: Voltage and Current Output Modules** drive valves, perform other crucial process operations, and provide up to eight channels of output which can be independently configured.

• **Discrete Input/Output Modules:** Provide multiple channels of input and output per module and offer advanced special functions as well as alarm capability.

The **System Backbone** resides within the DIN rail used for module mounting and provides power to and interface between the communications module and the I/O modules.

Figure 3: IPEmotion Screen Shots

Outstanding Functionality

As the MAQ20 system is a Modbus server, it can be operated remotely with no local PC. Additional features include:

- Up to 4GB of logged data can be transferred via FTP during real-time acquisition

- System firmware automatically registers installation and removal of I/O modules

- Equal load sharing boost power supply modules enable system expansion

- Hot swappable I/O modules with field-side pluggable terminal blocks on most models

- Sophisticated packaging allows high density mounting in 3U increments

- I/O modules can be mounted remotely from the communications module

Output modules are programmable for user-defined waveforms. Discrete I/O modules offer seven high level functions including pulse counter, frequency counter, waveform measurement, time between events, frequency generator, PWM generator, and one-shot pulse generator.

System power is connected to the communications module, which in turn powers the I/O modules. For systems with power supply requirements greater than those the communications module provides, the MAQ20-PWR3 boost power supply module can provide additional power. When a MAQ20 I/O module is inserted into a system, module registration occurs automatically, data acquisition starts, and data is stored locally in the module. The system is based on a Modbus compatible memory map, which ensures easy access to acquired data, configuration settings, and alarm limits. Information is stored in consistent locations from module to module for ease of use and system design.

Software Options

The options for intuitive graphical control software include:

- ReDAQ® Shape Graphical HMI Design & Runtime Solution

- IPEmotion Advanced Control & Mathematical Functions Solution

The MAQ20 system comes with free configuration software; programming examples and LabVIEW VIs are also available.

Leading-Edge PID Loop Control

The MAQ20 provides PID loop control with both software packages that support the system: ReDAQ Shape for MAQ20 and IPEmotion. With ReDAQ Shape, the powerful Dataforth MAQ20 communications module is capable of autonomously running up to 32 PID control loops; faceplates within the software enable an engineer or operator to configure the many features of loop control and monitor processes. With IPEmotion software, PID loop control is extensive and highly functional. An unlimited number of loops can be run; the only limiting factor is the processing power of the PC. Typical PID applications include steam, water, and chemical flow control; tank level control; heat-exchanger/reactor temperature control, and pressure control.

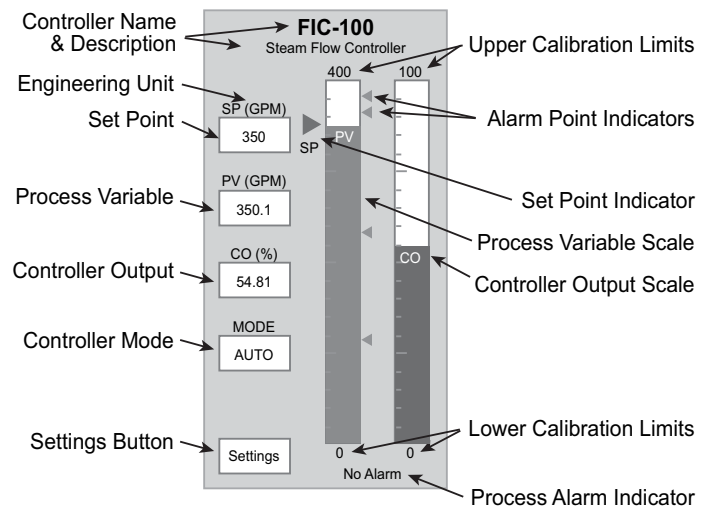Figure 5: PID Faceplate in ReDAQ Shape Software

Figure 4: ReDAQ Shape for MAQ20 Screen Shots

Like all Dataforth products, the MAQ20 system provides exceptional isolation, protection, accuracy, and reliability. All MAQ20 modules are designed for installation in Class I, Division 2 hazardous locations and have a high level of immunity to environmental noise commonly found in heavy industrial environments.

▶ MAQ®20 Data Acquisition System Selection Guide

COMMUNICATIONS MODULES Page 6

MODEL	DESCRIPTION
MAQ20-COM2	Communications Module; Ethernet, USB, RS-232
MAQ20-COM4	Communications Module, Ethernet; USB, RS-485

VOLTAGE & CURRENT ANALOG INPUT MODULES Page 8

MODEL	DESCRIPTION
MAQ20-MVDN	Analog Input Module; mV, 8-ch, Differential
MAQ20-VSN	Analog Input Module; V, 16-ch, Single Ended
MAQ20-VDN	Analog Input Module; V, 8-ch, Differential
MAQ20-ISN	Analog Input Module; mA, 16-ch, Single Ended
MAQ20-IDN	Analog Input Module; mA, 8-ch, Differential

THERMOCOUPLE ANALOG INPUT MODULES Page 10

MODEL	DESCRIPTION
MAQ20-JTC	Analog Input Module; Type J Thermocouple, 8-ch
MAQ20-KTC	Analog Input Module; Type K Thermocouple, 8-ch
MAQ20-TTC	Analog Input Module; Type T Thermocouple, 8-ch
MAQ20-RSTC	Analog Input Module; Type R and Type S Thermocouple, 8-ch

RTD and POTENTIOMETER ANALOG INPUT MODULES Page 12

MODEL	DESCRIPTION
MAQ20-RTD31	Analog Input Module; RTD/Potentiometer, 3-wire, Type Pt and Ni, 6-ch
MAQ20-RTD41◇	Analog Input Module; RTD, 4-wire, Type Pt and Ni, 5-ch

STRAIN GAGE ANALOG INPUT MODULE Page 14

MODEL	DESCRIPTION
MAQ20-BRDG1◇	Analog Input Module; Bridge/Strain Gage, 4-ch

FREQUENCY ANALOG INPUT MODULE Page 16

MODEL	DESCRIPTION
MAQ20-FREQ◇	Analog Input Module; Frequency, 8-ch

VOLTAGE & CURRENT ANALOG OUTPUT MODULES Page 18

MODEL	DESCRIPTION
MAQ20-VO	Analog Output Module; Voltage, 8-ch
MAQ20-IO	Analog Output Module; Current mA, 8-ch

DISCRETE INPUT / OUTPUT MODULES Page 20

MODEL	DESCRIPTION
MAQ20-DIOL	Discrete Input/Output Module; 3 to 60VDC In, 3 to 60VDC Out, 5-ch In, 5-ch Out
MAQ20-DIOH◇	Discrete Input/Output Module; 90 to 280VAC/VDC In, 24 to 280VAC Out, 4-ch In, 4-ch Out

SYSTEM BACKBONES Page 22

MODEL	DESCRIPTION
MAQ20-BKPL4	DIN Rail Backbone; 1 COM Module plus 4 I/O Modules
MAQ20-BKPL8	DIN Rail Backbone; 1 COM Module plus 8 I/O Modules
MAQ20-BKPL16	DIN Rail Backbone; 1 COM Module plus 16 I/O Modules
MAQ20-BKPL24	DIN Rail Backbone; 1 COM Module plus 24 I/O Modules

SOFTWARE Pages 24 and 26

MODEL	DESCRIPTION
MAQ20-940	ReDAQ Shape Software for MAQ20 – Developer Version
MAQ20-941	ReDAQ Shape Software for MAQ20 – User Version
MAQ20-945	MAQ20 Configuration Software Tool
MAQ20-951	IPEmotion Software for MAQ20 (1 COM module and 1 to 4 I/O modules)
MAQ20-952	IPEmotion Software for MAQ20 (Each additional 4 I/O modules)

ACCESSORIES Page 28

MODEL	DESCRIPTION
MAQ20-XCA01	Backbone Expansion Cable; 1 meter
MAQ20-XCA02	Backbone Expansion Cable; 2 meter
MAQ20-PWR3◇	Boost Power Supply Module

Cables to Interface 8B Backpanels to MAQ20-VSN Module

MODEL	DESCRIPTION
MAQ20-8B25-0.3	DB25-to-20 pos screw term Transition Cable, 0.3m long
MAQ20-8B25-0.6	DB25-to-20 pos screw term Transition Cable, 0.6m long
MAQ20-8B25-01	DB25-to-20 pos screw term Transition Cable, 1.0m long

MAQ20 Demonstration Suitcase

MODEL	DESCRIPTION
MAQ20DEMO-B	MAQ20 Demonstration Suitcase with Process Simulator for Sales Channels

◇ Preliminary at date of printing.
  Contact factory for availability.

Communications Modules
Provide Connection, Power, Interface

Description

The MAQ20 communications module is offered in two models and provides the connection between a host computer and a MAQ®20 Data Acquisition System. MAQ20-COM4 communicates using Ethernet, USB, or RS-485; MAQ20-COM2 uses Ethernet, USB, or RS-232. Ethernet communications use the Modbus TCP protocol and USB communications are based on the Modbus RTU protocol, which RS-485 and RS-232 communications also use. Serial communications over RS-485 can be either 2-wire or 4-wire.

When using the Ethernet interface, up to four simultaneous socket connections are supported and each socket can process up to four simultaneous Modbus TCP transactions. Serial communications over RS-232 or RS-485 can be run at baud rates as fast as 921.6kbps.

A very useful feature of the MAQ20 system is the capability to store acquired data locally for later analysis. This is provided by the easily accessible and removable 4GB micro-SD memory card that is in the MAQ20-COMx module and can be used to log data acquired from all input modules.

Each MAQ20-COMx module can interface to up to 24 I/O modules in any combination, allowing high channel counts and great flexibility in system configuration.

To power the system, a 7-34VDC power source is connected to the communications module. Regulated and protected supplies within the module then provide power both to the internal circuits and to all I/O modules in the system. When many high power I/O modules are used in a system, MAQ20-PWR3 load-sharing boost power supply modules can be installed in standard I/O module slots to provide the necessary additional power.

▶ Features

- Connect Host Computer and MAQ®20 System
- Communicate using Ethernet, USB, RS-485, RS-232
- Up to 4 Simultaneous Socket Connections with Ethernet
- Baud Rates to 921.6kbps with RS-232/RS-485
- Follow Modbus TCP or RTU Protocols
- Store Acquired Data Locally
- Interface to up to 24 I/O Modules
- 50VDC Communications Interface-to-Bus Isolation

To ensure robustness, the communications interface-to-bus isolation is 50VDC and power input terminals are protected against overvoltage, transient, and reverse connections.

As a minimum, a MAQ®20 Data Acquisition System must have a communications module, a backbone, and one I/O module.
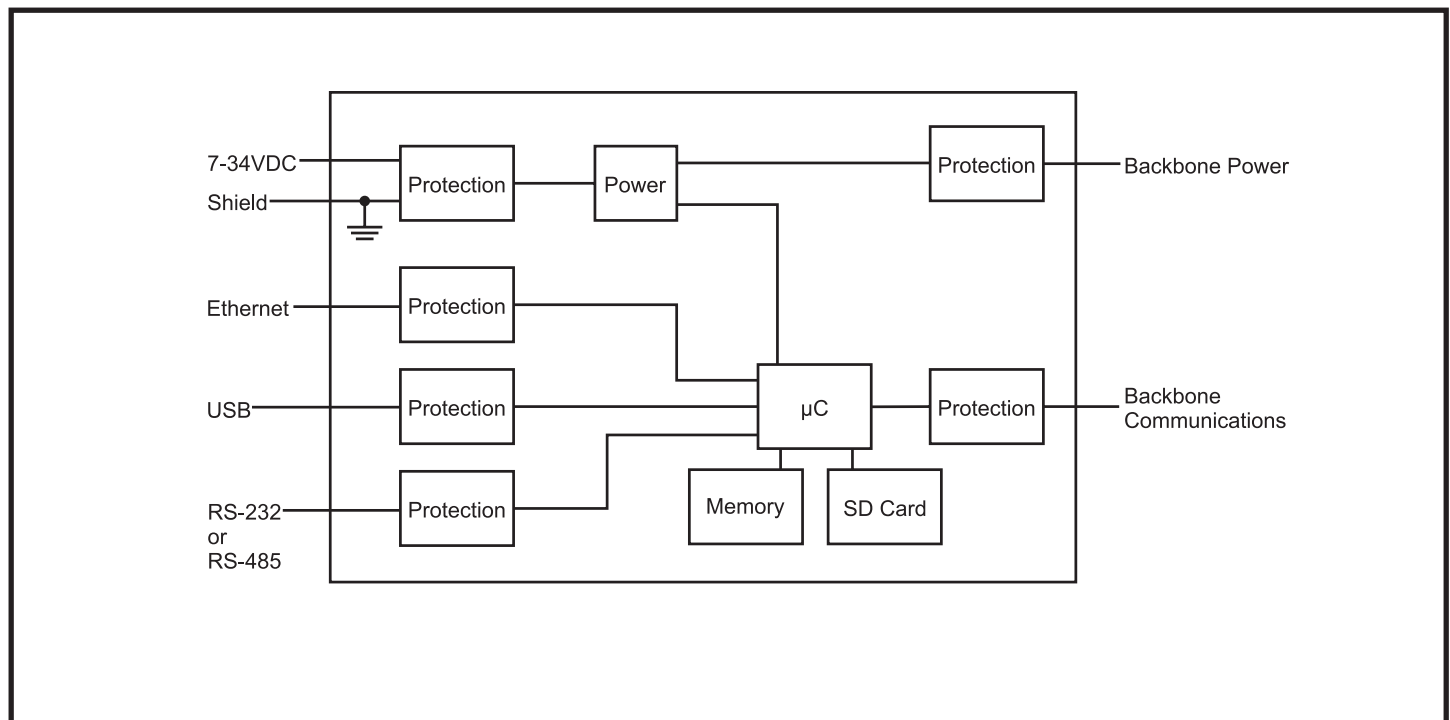

Figure 1: MAQ20 Communications Module Block Diagram

Specifications

Module	Description
MAQ20-COM4	Ethernet, USB, RS-485
MAQ20-COM2	Ethernet, USB, RS-232
Communications	
Ethernet	10/100 Base-T (1000 Base-T compatible)
	RJ-45, Modbus TCP
USB	USB 2.0, Type B,
	Proprietary Modbus over USB
RS-485	2-wire or 4-wire, up to 921.6kbps,
	up to 4000 ft, RJ-45, Modbus RTU
RS-232	Up to 921.6kbps, RJ-45, Modbus RTU
CMV	
Power-to-Bus	50VDC
Communication Port-to-Bus	50VDC
Transient	ANSI/IEEE C37.90.1
Power Supply	
Input Power	7-34VDC at 2A max
Power to Bus	5VDC at 3A max
Dimensions (h)(w)(d)	4.51" x 1.11" x 3.26"
	(114.6mm x 28.2mm x 82.8mm)
Environmental	
Operating Temperature	–40°C to +85°C
Storage Temperature	–40°C to +85°C
Relative Humidity	0 to 95% Noncondensing
Emissions, EN61000-6-4	ISM Group 1
Radiated, Conducted	Class A
Immunity EN61000-6-2	ISM Group 1
RF	Performance A
ESD, EFT	Performance B
Certifications	Heavy Industrial CE, ATEX Pending
	UL/CUL Class I, Division 2,
	Groups A, B, C, D Pending

Ordering Information

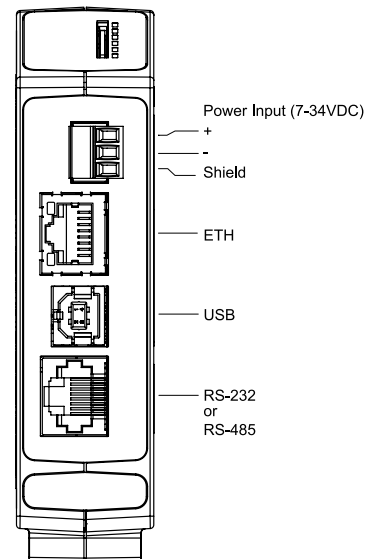| Model	Description
MAQ20-COM4	Ethernet, USB, RS-485
MAQ20-COM2	Ethernet, USB, RS-232

Figure 2: Communications Module

Figure 3: Communications Module Input Connections

For full details on module operation, refer to MA1040 – MAQ20 Communications Module Hardware User Manual, available for download at: www.dataforth.com/maq20_download.aspx

Analog Input Modules: Voltage & Current
Interface to Volt, Millivolt, and Milliamp Sensors & Equipment

Description

MAQ20 voltage and current analog input modules interface to a wide range of volt, millivolt, and milliamp sensors and equipment used in industrial and test and measurement applications. They offer 8-channel differential input or 16-channel single-ended input for precise measurement of voltage and current signals. All channels are individually configurable for range, alarm limits, and averaging to match the most demanding applications. High, Low, High-High and Low-Low alarms provide essential monitoring and warning functions to ensure optimum process flow and fail-safe operation. Hardware low-pass filtering in each channel provides rejection of 50 and 60Hz line frequencies. Field I/O connections are made through a pluggable terminal block with four positions provided for the termination of wiring shields.

Input-to-bus isolation is a robust 1500Vrms and each individual channel is protected up to 240Vrms continuous overload in case of inadvertent wiring errors. Overloaded channels do not adversely affect other channels in the module, thereby preserving data integrity.

Channels in a module can be selectively enabled for scanning. All channels are enabled by default; however, non-used channels can be disabled to increase the sampling rate of enabled channels.

Input ranges are selectable on a per-channel basis. The MAQ20-MVDN, -VDN, and -VSN modules have five user selectable input ranges; the MAQ20-IDN and -ISN modules have two. Over-range and under-range up to 2% beyond the specified input values is allowed, and accuracy is guaranteed to ±f.s.

Cables to interface 8B backpanels to the MAQ20-VSN module are available; the 8B modules and backpanel assembly provide 1500Vrms channel-to-channel isolation.

▶ Features

- Interface to Volt, Millivolt, Milliamp Sensors and Equipment
- 8-Channel Differential or 16-Channel Single-Ended Input
- All Channels Individually Configurable for Range, Alarms, Averaging
- 1500Vrms Input-to-Bus Isolation
- Each Channel Protected up to 240Vrms Continuous Overload
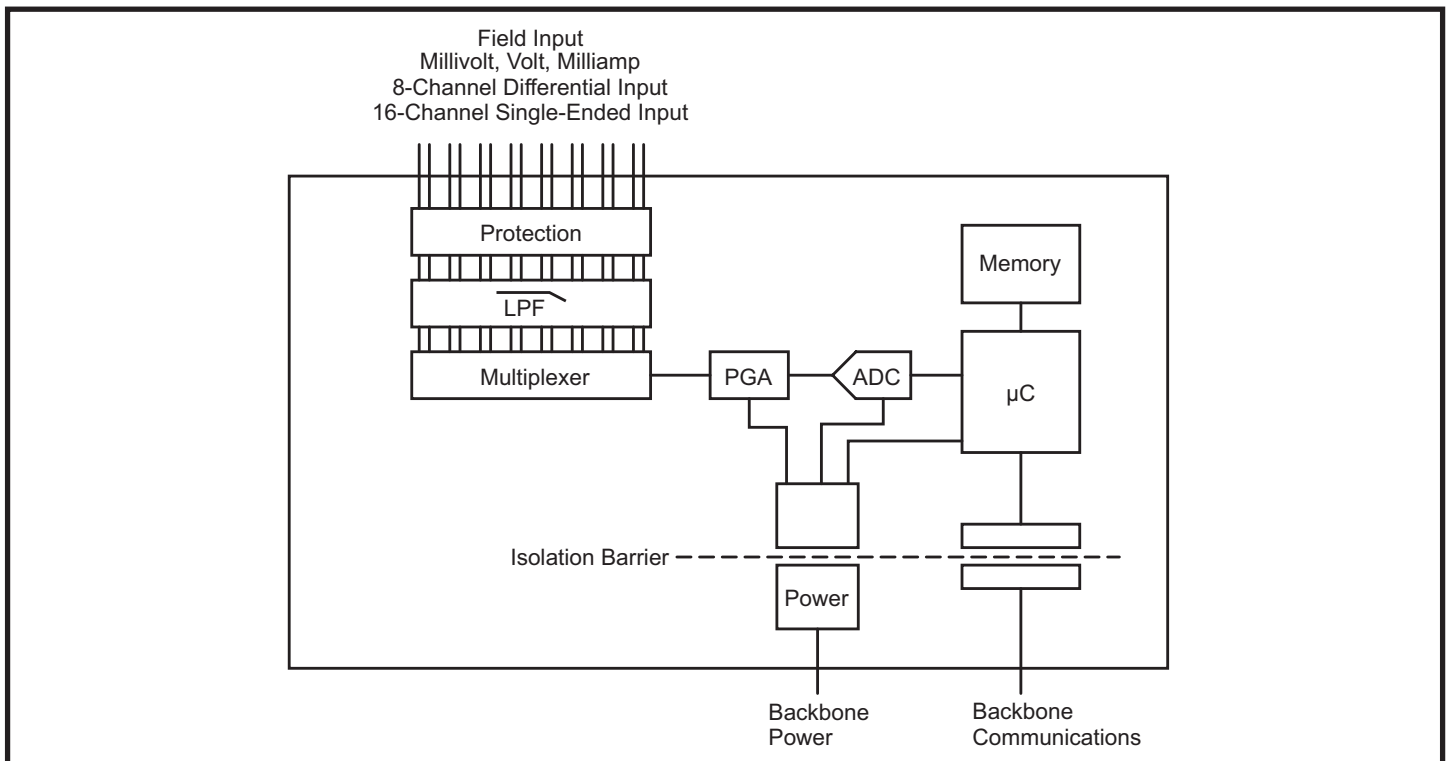- Selective Enabling of Module Channels for Scanning

Figure 1: MAQ20 Voltage & Current Input Module Block Diagram

Specifications
Typical* at T_A=+25°C and +24VDC system power

Module	Description
MAQ20-MVDN	8-channel, milliVolt, Differential Input ±50mV, ±100mV, ±250mV, ±1.0V, ±2.0V (Default ±1.0V)
MAQ20-VDN	8-channel, Volt, Differential Input ±5V, ±10V, ±20V, ±40V, ±60V (Default ±5V)
MAQ20-VSN	16-channel, Volt, Single-Ended Input ±5V, ±10V, ±20V, ±40V, ±60V (Default ±5V)
MAQ20-IDN	8-channel, milliAmp, Differential Input 0-20mA, 4-20mA (Default 0-20mA)
MAQ20-ISN	16-channel, milliAmp, Single-Ended Input 0-20mA, 4-20mA (Default 0-20mA)

Per Channel Setup	Individually configurable for range, alarms, averaging
Input Protection	
Continuous	240Vrms max
Transient	ANSI/IEEE C37.90.1
CMV	
Channel-to-Bus	1500Vrms, 1 min
Channel-to-Channel	±28V peak (-VDN), ±3V peak (-MVDN, -IDN), 0V (-VSN, -ISN)
Transient	ANSI/IEEE C37.90.1
CMR	100dB at 50/60Hz
NMR	30dB at 50/60Hz

Accuracy[1]	±0.035% span
Linearity / Conformity	±0.02% span
Resolution	0.012% span
Stability	
Zero	±15ppm/C
Span	±35ppm/C

Bandwidth, −3dB	3Hz
Scan Rate	200 Ch/s
Alarms	High / High-High / Low / Low-Low
Power Supply Current	30mA

Dimensions (h)(w)(d)	4.51" x 0.60" x 3.26" (114.6mm x 15.3mm x 82.8mm)

Environmental	
Operating Temperature	−40°C to +85°C
Storage Temperature	−40°C to +85°C
Relative Humidity	0 to 95% Noncondensing
Emissions, EN61000-6-4	ISM Group 1
Radiated, Conducted	Class A
Immunity EN61000-6-2	ISM Group 1
RF	Performance A ±0.5% Span Error
ESD, EFT	Performance B

Certifications	Heavy Industrial CE, ATEX Pending UL/CUL Class I, Division 2, Groups A, B, C, D Pending

NOTES:
* Contact factory or your local Dataforth sales office for maximum values.
(1) Includes linearity/conformity, hysteresis and repeatability.

Ordering Information

Model	Description
MAQ20-MVDN	Analog Input Module; mV, 8-ch, Differential
MAQ20-VSN	Analog Input Module; V, 16-ch, Single Ended
MAQ20-VDN	Analog Input Module; V, 8-ch, Differential
MAQ20-ISN	Analog Input Module; mA, 16-ch, Single Ended
MAQ20-IDN	Analog Input Module; mA, 8-ch, Differential

Cables to Interface 8B Backpanels to MAQ20-VSN Module

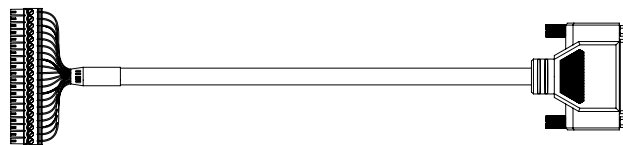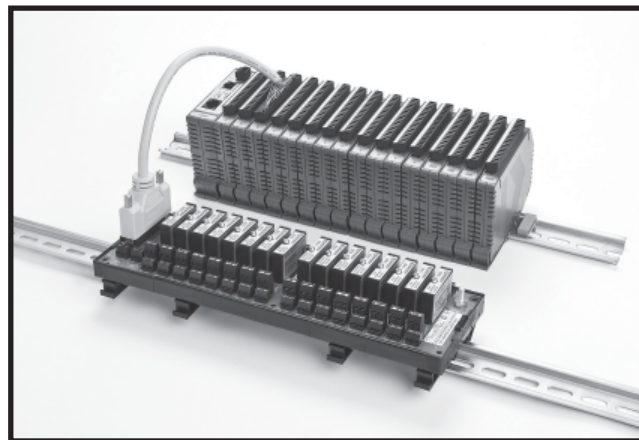| Model	Description
MAQ20-8B25-0.3	DB25-to-20 pos screw term Transition Cable, 0.3m long
MAQ20-8B25-0.6	DB25-to-20 pos screw term Transition Cable, 0.6m long
MAQ20-8B25-01	DB25-to-20 pos screw term Transition Cable, 1.0m long

Figure 2: 8B Backpanel Interface Cable

Figure 3: Cable Interfacing 8B Backpanel to MAQ20-VSN Module

For input connections and full details on module operation, refer to MA1041 – MAQ20 mV-V-mA Input Module Hardware User Manual, available for download at: www.dataforth.com/maq20_download.aspx

Analog Input Modules: Thermocouple
Interface to Types J, K, T, R and S Thermocouples

Description

The MAQ20 thermocouple analog input modules have 8 differential input channels. Separate models are offered for interfacing to Type J, Type K, Type T and Types R and S thermocouples. Cold Junction Compensation uses four internal sensors resulting in industry leading measurement accuracy in any system configuration and over the entire system operating temperature range. All channels are individually configurable for range, alarm limits, and averaging to match the most demanding applications. High, Low, High-High and Low-Low alarms provide essential monitoring and warning functions to ensure optimum process flow and fail-safe operation. Hardware low-pass filtering in each channel provides rejection of 50 and 60Hz line frequencies. Field I/O connections are made through spring cage terminal blocks with four positions provided for the termination of wiring shields.

Input-to-bus isolation is a robust 1500Vrms and each individual channel is protected up to 150Vrms continuous overload in case of inadvertent wiring errors. Overloaded channels do not adversely affect other channels in the module, thereby preserving data integrity.

Channels in a module can be selectively enabled for scanning. All channels are enabled by default; however, non-used channels can be disabled to increase the sampling rate of enabled channels.

Input ranges are selectable on a per-channel basis. The MAQ20-JTC, -KTC, -TTC and -RSTC modules have two to four user selectable input ranges, depending on the model. Over-range and under-range up to 2% beyond the specified input values is allowed. Sensor linearization is performed in the module, and accuracy is guaranteed to ±f.s.

▶ Features

- 8 Differential Input Channels
- Interface to Types J, K, T , R and S Thermocouples
- All Channels Individually Configurable for Range, Alarms, Averaging
- 1500Vrms Input-to-Bus Isolation
- Each Channel Protected up to 150Vrms Continuous Overload
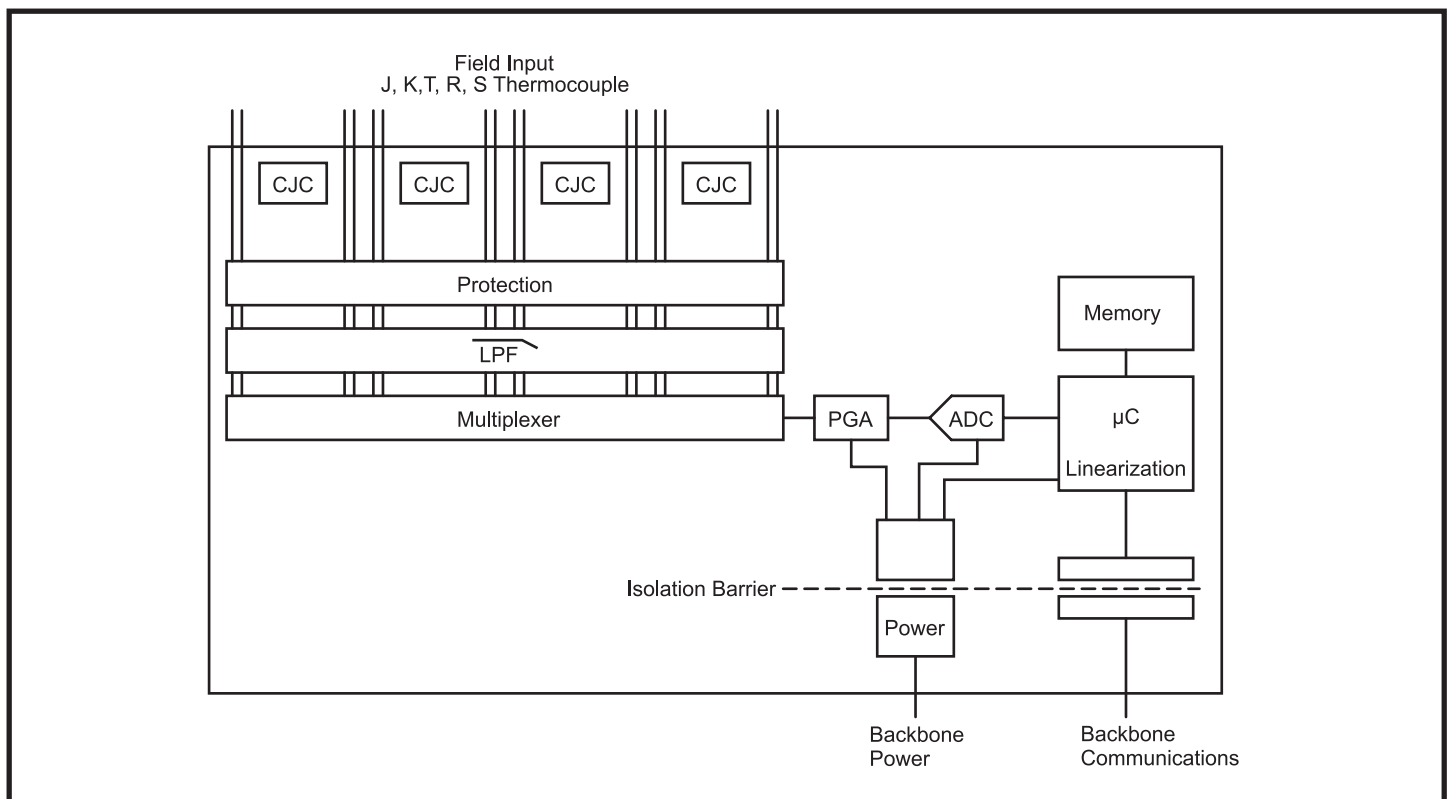- Selective Enabling of Module Channels for Scanning

Figure 1: MAQ20 Thermocouple Input Module Block Diagram

Specifications
Typical* at T_A=+25°C and +24VDC system power

Module	Description
MAQ20-JTC	8-ch., Type JTC, Differential Input –100°C to +760°C (Default) –100°C to +393°C, –100°C to +199°C
MAQ20-KTC	8-ch., Type KTC, Differential Input –100°C to +1350°C (Default) –100°C to +651°C, –100°C to +332°C
MAQ20-TTC	8-channel, Type TTC, Differential Input –100°C to +400°C (Default), –100°C to +220°C
MAQ20-RSTC	8-channel, Type RTC and Type STC, Differential Input Type R–100°C to +1750°C (Default), –100°C to +990°C Type S: –100°C to +1750°C, –100°C to +970°C

Per Channel Setup	Individually configurable for range, alarms, averaging
Input Protection	
Continuous	150Vrms max
Transient	ANSI/IEEE C37.90.1
CMV	
Channel-to-Bus	1500Vrms, 1 min
Channel-to-Channel	±3V peak
Transient	ANSI/IEEE C37.90.1
CMR	100dB at 50/60Hz
NMR	26dB at 50/60Hz

Accuracy[1]	±0.06% span
Conformity	±0.035% span
Cold Junction Compensation	±0.25°C at +25°C, ±1.0°C at –40°C to +85°C
Resolution	0.020% span
Stability	
Zero	±15ppm/°C
Span	±35ppm/°C

Bandwidth, –3dB	3Hz
Scan Rate	200 Ch/s
Alarms	High / High-High / Low / Low-Low
Open Input Response	Downscale, <5s, Flag Set
Power Supply Current	30mA

Dimensions (h)(w)(d)	4.51" x 0.60" x 3.26" (114.6mm x 15.3mm x 82.8mm)

Environmental	
Operating Temperature	–40°C to +85°C
Storage Temperature	–40°C to +85°C
Relative Humidity	0 to 95% Noncondensing
Emissions, EN61000-6-4	ISM Group 1
Radiated, Conducted	Class A
Immunity EN61000-6-2	ISM Group 1
RF	Performance A ±0.5% Span Error
ESD, EFT	Performance B

Certifications	Heavy Industrial CE, ATEX Pending UL/CUL Class I, Division 2, Groups A, B, C, D Pending

NOTES:
* Contact factory or your local Dataforth sales office for maximum values.
(1) Includes conformity, hysteresis and repeatability. Does not include CJC accuracy.

Ordering Information

Model	Description
MAQ20-JTC	Analog Input Module; Type J Thermocouple, 8-ch
MAQ20-KTC	Analog Input Module; Type K Thermocouple, 8-ch
MAQ20-TTC	Analog Input Module; Type T Thermocouple, 8-ch
MAQ20-RSTC	Analog Input Module; Type R and Type S Thermocouple, 8-ch

For input connections and full details on module operation, refer to MA1047 – MAQ20 Thermocouple Input Module Hardware User Manual, available for download at: www.dataforth.com/maq20_download.aspx

Analog Input Modules: RTD and Potentiometer
Interface to 3-Wire and 4-Wire Sensors

Description

Two MAQ20 resistance input modules are offered. One interfaces to 3-wire sensors and has 6 input channels; the other interfaces to 4-wire sensors and has 5 input channels. The 3-wire module interfaces to 3 types of sensors: 100Ω Pt and 120Ω Ni RTDs, and potentiometers; the 4-wire module interfaces to 100Ω Pt and 120Ω Ni RTDs. Precision, low magnitude current sources are used to minimize sensor self-heating and cancel lead resistance errors when using 3-wire sensors. All channels are individually configurable for sensor, range, alarms, and averaging to match the most demanding applications. High, Low, High-High and Low-Low alarms provide essential monitoring and warning functions to ensure optimum process flow and fail-safe applications. Hardware low-pass filtering in each channel provides rejection of 50 and 60Hz line frequencies. Field I/O connections are made through a pluggable terminal block with positions designated for the termination of wiring shields.

Input-to-bus isolation is a robust 1500Vrms and each individual channel is protected up to 240Vrms continuous overload in case of inadvertent wiring errors. Overloaded channels do not adversely affect other channels in the module, which preserves data integrity.

Channels in a module can be selectively enabled for scanning. All channels are enabled by default; however, non-used channels can be disabled to increase the sampling rate of enabled channels.

Input sensors and input ranges are selectable on a per-channel basis. One to three ranges are available depending on the input sensor. Over-range and under-range up to 2% beyond the specified input values is allowed. Sensor linearization is performed in the module, and accuracy is guaranteed to ±f.s.

▶ Features

- 6 Input Channels for 3-Wire Sensors
- 5 Input Channels for 4-Wire Sensors
- Interface to Pt100, Ni120 RTDs, and Potentiometers
- All Channels Individually Configurable for Sensor, Range, Alarms, Averaging
- 1500Vrms Input-to-Bus Isolation
- Each Channel Protected up to 240Vrms Continuous Overload
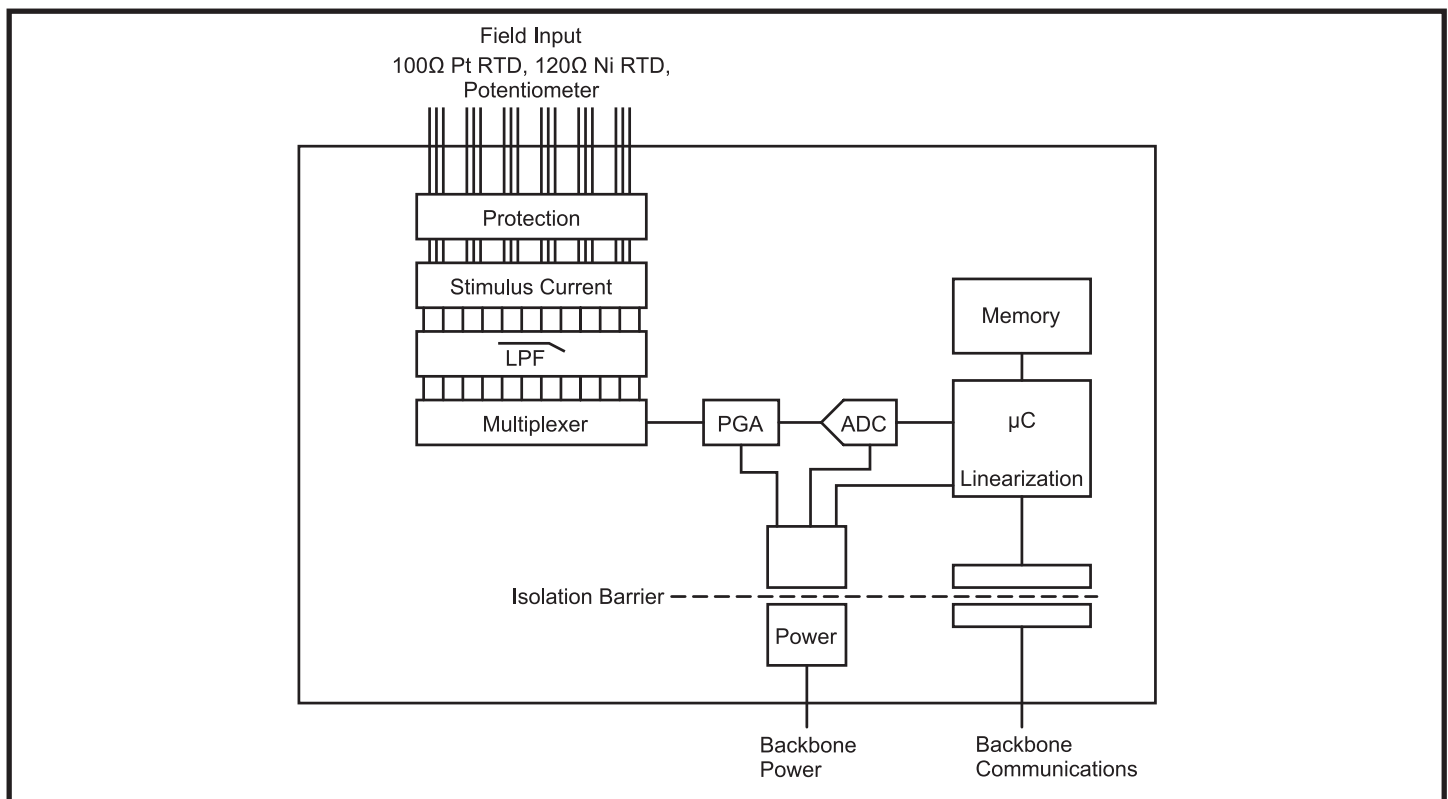- Selective Enabling of Module Channels for Scanning

Figure 1: MAQ20-RTD31 RTD and Potentiometer Input Module Block Diagram

Specifications
Typical* at T_A=+25°C and +24VDC system power

Module	Description
MAQ20-RTD31	6-channel, 3-wire Pt100, Ni120, Potentiometer Input 100Ω Pt a = 0.00385; –100°C to +850°C (Default) 100Ω Pt100 a = 0.00385; –200°C to +200°C Pt100 a = 0.00385; –100°C to +100°C Ni120 a = 0.00672; –80°C to +300°C Potentiometer 0Ω to 5kΩ
MAQ20-RTD41◊	5-channel, 4-wire Pt100, Ni120 100Ω Pt a = 0.00385; –100°C to +850°C (Default) 100Ω Pt100 a = 0.00385; –200°C to +200°C Pt100 a = 0.00385; –100°C to +100°C Ni120 a = 0.00672; –80°C to +300°C

Per Channel Setup	Individually configurable for sensor, range, alarms, averaging
Input Protection	
Continuous	240Vrms max
Transient	ANSI/IEEE C37.90.1
CMV	
Channel-to-Bus	1500Vrms, 1 min
Channel-to-Channel	±3V peak
Transient	ANSI/IEEE C37.90.1
CMR	100dB at 50/60Hz
NMR	20dB at 50/60Hz

Accuracy[1]	±0.06% span
Conformity	±0.035% span
Resolution	0.012% span
Stability	
Zero	±50ppm/°C
Span	±35ppm/°C

Bandwidth, –3dB	3Hz
Scan Rate	200 Ch/s
Alarms	High / High-High / Low / Low-Low
Open Input Response	Upscale or Downscale, <5s, Flag Set
Power Supply Current	35mA

Dimensions (h)(w)(d)	4.51" x 0.60" x 3.26" (114.6mm x 15.3mm x 82.8mm)

Environmental	
Operating Temperature	–40°C to +85°C
Storage Temperature	–40°C to +85°C
Relative Humidity	0 to 95% Noncondensing
Emissions, EN61000-6-4	ISM Group 1
Radiated, Conducted	Class A
Immunity EN61000-6-2	ISM Group 1
RF	Performance A ±0.5% Span Error
ESD, EFT	Performance B

Certifications	Heavy Industrial CE, ATEX Pending UL Class I, Division 2, Groups A, B, C, D Pending

Model	Description
MAQ20-RTD31	Analog Input Module; RTD/Potentiometer, 3-Wire, Type Pt and Ni, 6-ch
MAQ20-RTD41◊	Analog Input Module; RTD, 4-Wire, Type Pt and Ni, 5-ch

NOTES:

∗ Contact factory or your local Dataforth sales office for maximum values.

◊ Preliminary at date of printing. Contact factory for availability.

(1) Includes conformity, hysteresis and repeatability.

For input connections and full details on module operation, refer to MA1044 – MAQ20 RTD-Potentiometer Input Module Hardware User Manual, available for download at: www.dataforth.com/maq20_download.aspx

Analog Input Module: Strain Gage◇
Interface to Full, Half, and Quarter Bridge Sensors

Description

The MAQ20 strain gage input module offers 4 input channels and can interface to full, half, and quarter bridge sensors using 4-wire or 6-wire connections. All channels are individually configurable for range, alarms, and averaging to match the most demanding applications. In addition, sampling rate, resolution, bandwidth, excitation voltage, and shunt calibration are user settable parameters. Input signals are sampled simultaneously and burst mode can be used to capture fast events. High, Low, High-High and Low-Low alarms provide essential monitoring and warning functions to ensure optimum process flow and fail-safe applications. Hardware low-pass filtering in each channel provides rejection of unwanted frequencies. Field I/O connections are made through spring cage terminal blocks with positions designated for the termination of wiring shields.

Input-to-bus isolation is a robust 1500Vrms and each individual channel is protected up to 30Vrms continuous overload in case of inadvertent wiring errors. Overloaded channels do not adversely affect other channels in the module, which preserves data integrity.

Input ranges are selectable on a per-channel basis. Four ranges are available. Over-range and under-range up to 2% beyond the specified input values is allowed, and accuracy is guaranteed to ±f.s.

◇ Preliminary at date of printing.
  Contact factory for availability.

▶ Features

- 4 Input Channels for 4-Wire or 6-Wire Sensors
- Interface to Full, Half and Quarter (with external bridge completion) Sensors
- All Channels Individually Configurable for Range, Alarms, Averaging
- Programmable Sampling Rate & Resolution
- Simultaneous Sampling of Input Signals
- Burst Mode for Capturing Fast Events
- Programmable Bandwidth, Excitation, Shunt Calibration
- 1500Vrms Input-to-Bus Isolation
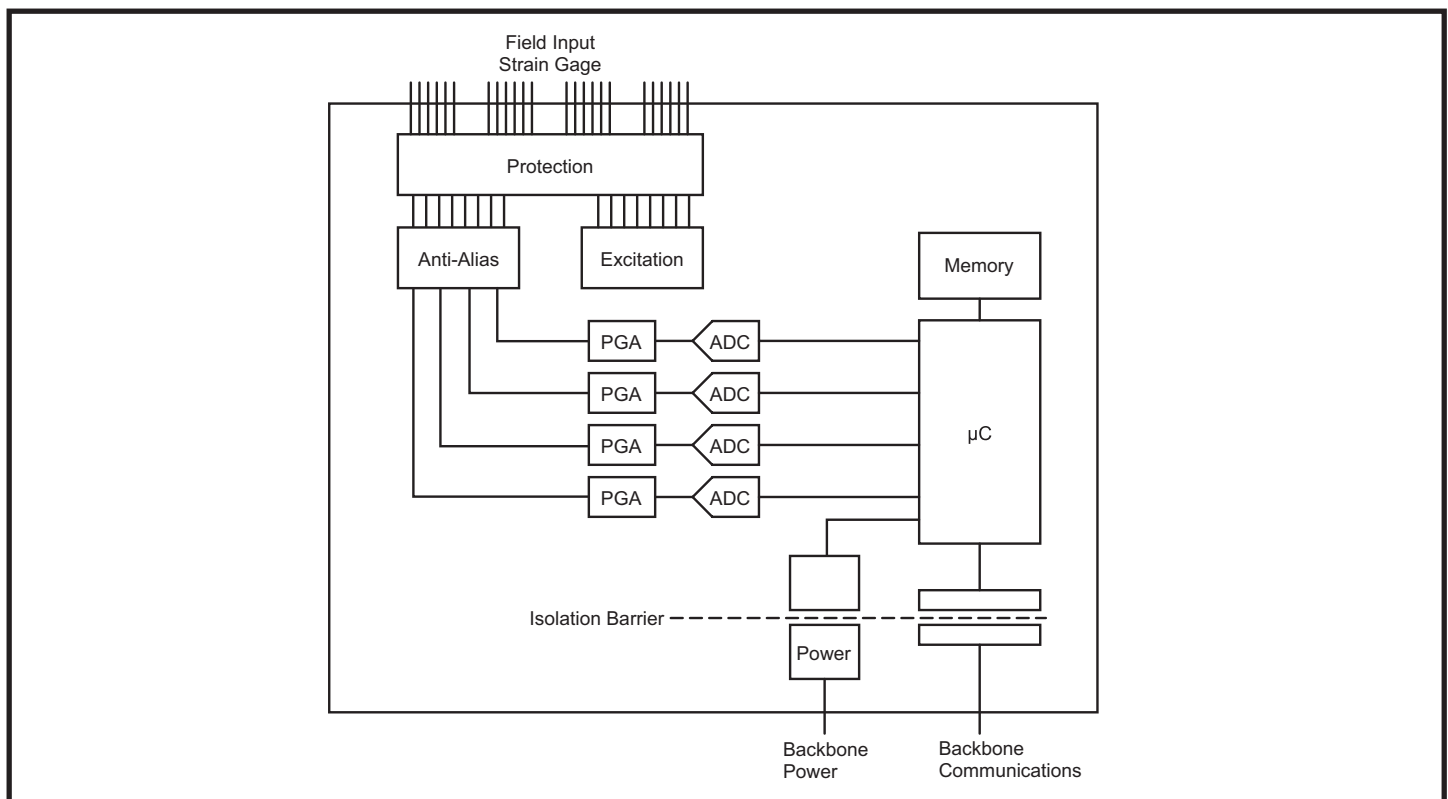- Each Channel Protected up to 30Vrms Continuous Overload

Figure 1: MAQ20 Strain Gage Input Module Block Diagram

Specifications Typical* at T_A=+25°C and +24VDC system power

Module	Description
MAQ20-BRDG1◇ Input Range Excitation Voltage Shunt Calibration	4-channel, Full, Half, Quarter Bridge (w/ Ext. Bridge Compl.) 4-wire or 6-wire connection 1.25mV/V, 2.5mV/V, 5mV/V, 10mV/V Sensitivity 2.5V, 3.333V, 5.0V, 10.0V 14.7kΩ, 43.2kΩ
Per Channel Setup Input Protection 　　Continuous 　　Transient CMV 　　Channel-to-Bus 　　Channel-to-Channel 　　Transient CMR NMR	Individually configurable for range, alarms, averaging 30Vrms max ANSI/IEEE C37.90.1 1500Vrms, 1 min ±3V peak ANSI/IEEE C37.90.1 100dB at 50/60Hz 60dB/decade
Accuracy[1] Linearity Resolution Stability 　　Zero 　　Span	±0.03% span ±0.01% span 0.0005% to 0.005% span ±50ppm/°C ±75ppm/°C
Bandwidth, –3dB Sampling Rate, Simultaneous Alarms Power Supply Current	Programmable to 10kHz 1kS/s to 64kS/s burst High / High-High / Low / Low-Low 600mA
Dimensions (h)(w)(d)	4.51" x 0.60" x 3.26" (114.6mm x 15.3mm x 82.8mm)
Environmental 　　Operating Temperature 　　Storage Temperature 　　Relative Humidity Emissions, EN61000-6-4 　　Radiated, Conducted Immunity EN61000-6-2 　　RF 　　ESD, EFT	–40°C to +85°C –40°C to +85°C 0 to 95% Noncondensing ISM Group 1 Class A ISM Group 1 Performance A ±0.5% Span Error Performance B
Certifications	Heavy Industrial CE, ATEX Pending UL Class I, Division 2, Groups A, B, C, D Pending

Ordering Information

Model	Description
MAQ20-BRDG1◇	Analog Input Module; Bridge/Strain Gage, 4-ch

NOTES:

* Contact factory or your local Dataforth sales office for maximum values.

◇ Preliminary at date of printing. Contact factory for availability.

(1) Includes conformity, hysteresis and repeatability.

**For input connections and full details on module operation,
refer to MA1046 – MAQ20 Strain Gage Input Module
Hardware User Manual, available for download at:
www.dataforth.com/maq20_download.aspx**

Analog Input Module: Frequency◇

Measure Frequencies to 1MHz

Description

The MAQ20 frequency input module offers 8 input channels for measuring frequencies up to 1MHz. All channels are individually configurable for range and alarms to match the most demanding applications. Four controllable outputs can be used for sensor excitation or as 5V logic compatible outputs. High, Low, High-High and Low-Low alarms provide essential monitoring and warning functions to ensure optimum process flow and fail-safe applications. Field I/O connections are made through a pluggable terminal block with positions designated for the termination of wiring shields.

Input-to-bus isolation is a robust 1500Vrms and each individual channel is protected up to 240Vrms continuous.

Channels in a module can be selectively enabled for scanning. All channels are enabled by default; however, non-used channels can be disabled to increase the system sampling rate of enabled channels.

◇ Preliminary at date of printing.
  Contact factory for availability.

▶ Features

- 8 Input Channels
- 50mV Sensitivity
- Frequency Range – 0.5Hz to 1MHz plus State Change
- Operating Range – DC + Signal ≤300Vrms
- All Channels Individually Configurable for Range and Alarms
- 4 Excitation Sources to Power Sensors or Provide 5V Logic Compatible Output
- 1500Vrms Input-to-Bus Isolation
- Each Channel Protected up to 240Vrms
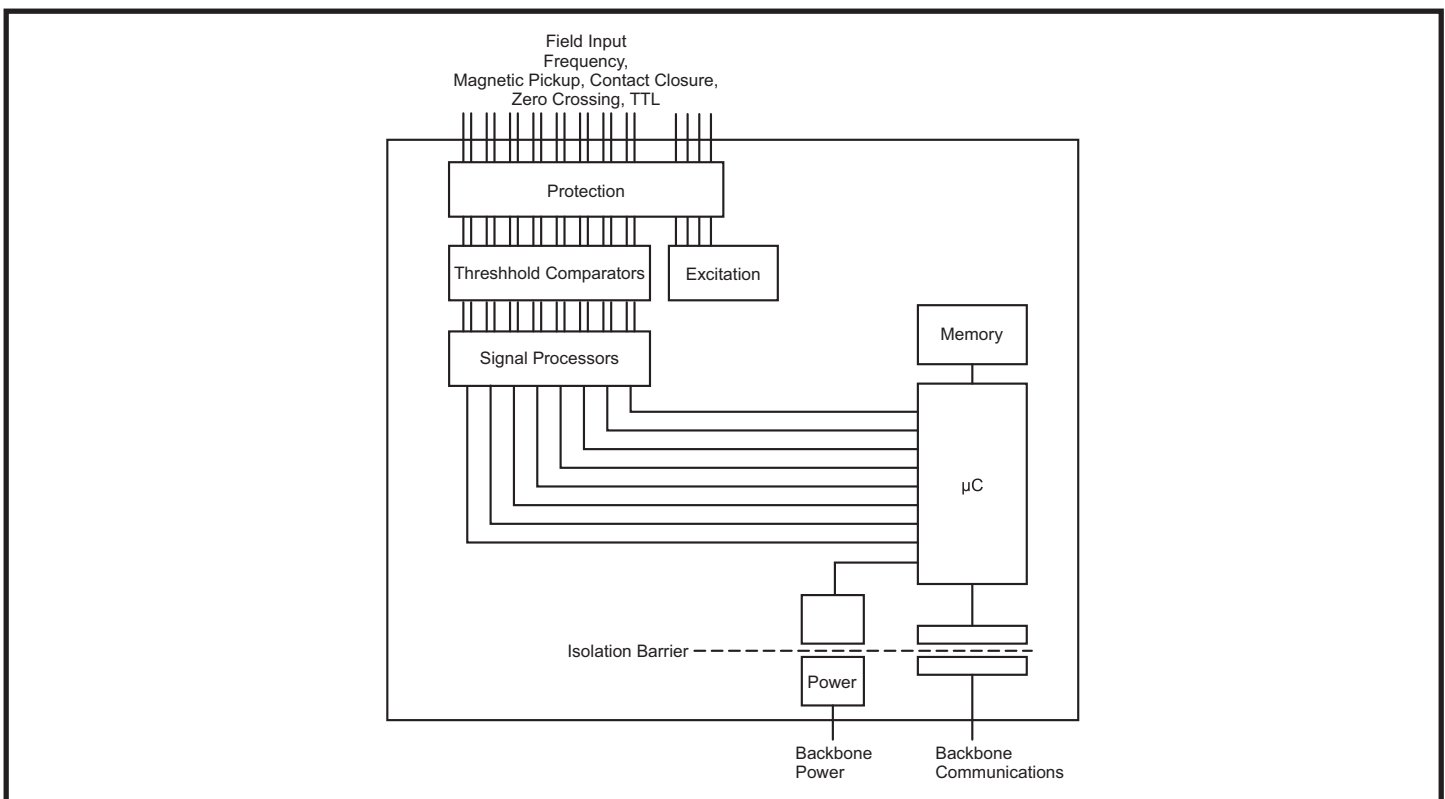- Selective Enabling of Module Channels for Scanning

Figure 1: MAQ20 Frequency Input Module Block Diagram

Specifications
Typical* at T_A=+25°C and +24VDC system power

Module	Description
MAQ20-FREQ◇	8-channel, Frequency Input, 0.5Hz to 1MHz, plus state change detect
Input Signal	50mV Sensitivity
	Operating Range: DC + signal ≤300Vrms
Excitation	Four 5V sources at 8mA each
	Use for sensor excitation or 5V logic compatible output
Per Channel Setup	Individually configurable for range, alarms
Input Protection	
Continuous	240Vrms max
Transient	ANSI/IEEE C37.90.1
CMV	
Channel-to-Bus	1500Vrms, 1 min
Channel-to-Channel	0V
Transient	ANSI/IEEE C37.90.1
Resolution and Accuracy	32 bits
Clock Accuracy	±0.003%
Clock Accuracy Over Temp	±0.01%, −40°C to +85°C
Scan Rate	1000 Ch/s
Alarms	High / High-High / Low / Low-Low
Power Supply Current	400mA
Dimensions (h)(w)(d)	4.51" x 0.60" x 3.26" (114.6mm x 15.3mm x 82.8mm)
Environmental	
Operating Temperature	−40°C to +85°C
Storage Temperature	−40°C to +85°C
Relative Humidity	0 to 95% Noncondensing
Emissions, EN61000-6-4	ISM Group 1
Radiated, Conducted	Class A
Immunity EN61000-6-2	ISM Group 1
RF	Performance A ±0.5% Span Error
ESD, EFT	Performance B
Certifications	Heavy Industrial CE, ATEX Pending
	UL Class I, Division 2, Groups A, B, C, D Pending

NOTES:
* Contact factory or your local Dataforth sales office for maximum values.
◇ Preliminary at date of printing. Contact factory for availability.

Ordering Information

Model	Description
MAQ20-FREQ◇	Analog Input Module; Frequency, 8-ch

For input connections and full details on module operation, refer to MA1048 – MAQ20 Frequency Input Module Hardware User Manual, available for download at: www.dataforth.com/maq20_download.aspx

Analog Output Modules: Voltage & Current
8 Isolated Voltage or Current Outputs

Description

The MAQ20 voltage output module and current output module offer 8 isolated voltage or current outputs. All channels are individually configurable for range and programmable output to match the most demanding applications. High-level per-channel isolation gives the module unmatched ruggedness and flexibility while default outputs provide essential functionality for fail-safe systems. User defined waveform outputs allow application-specific sophisticated, autonomous control. Field output connections are made through a pluggable terminal block which simplifies wiring during system setup and reconfiguration.

Input-to-bus isolation is a robust 1500Vrms and channel-to-channel isolation is 300Vrms. In addition, each channel is protected up to 40Vrms continuous overload in case of inadvertent wiring errors.

Channels in a module can be selectively enabled for output. All channels are enabled by default; however, non-used channels can be disabled to increase the refresh rate of enabled channels.

▶ Features

- 8 Isolated Output Channels
- Voltage or Current Output
- All Channels Individually Configurable for Range and Programmable Output
- User-Defined Default Output and Output Waveform
- 1500Vrms Input-to-Bus Isolation
- 300Vrms Channel-to-Channel Isolation
- Each Channel Protected up to 40Vrms Continuous Overload
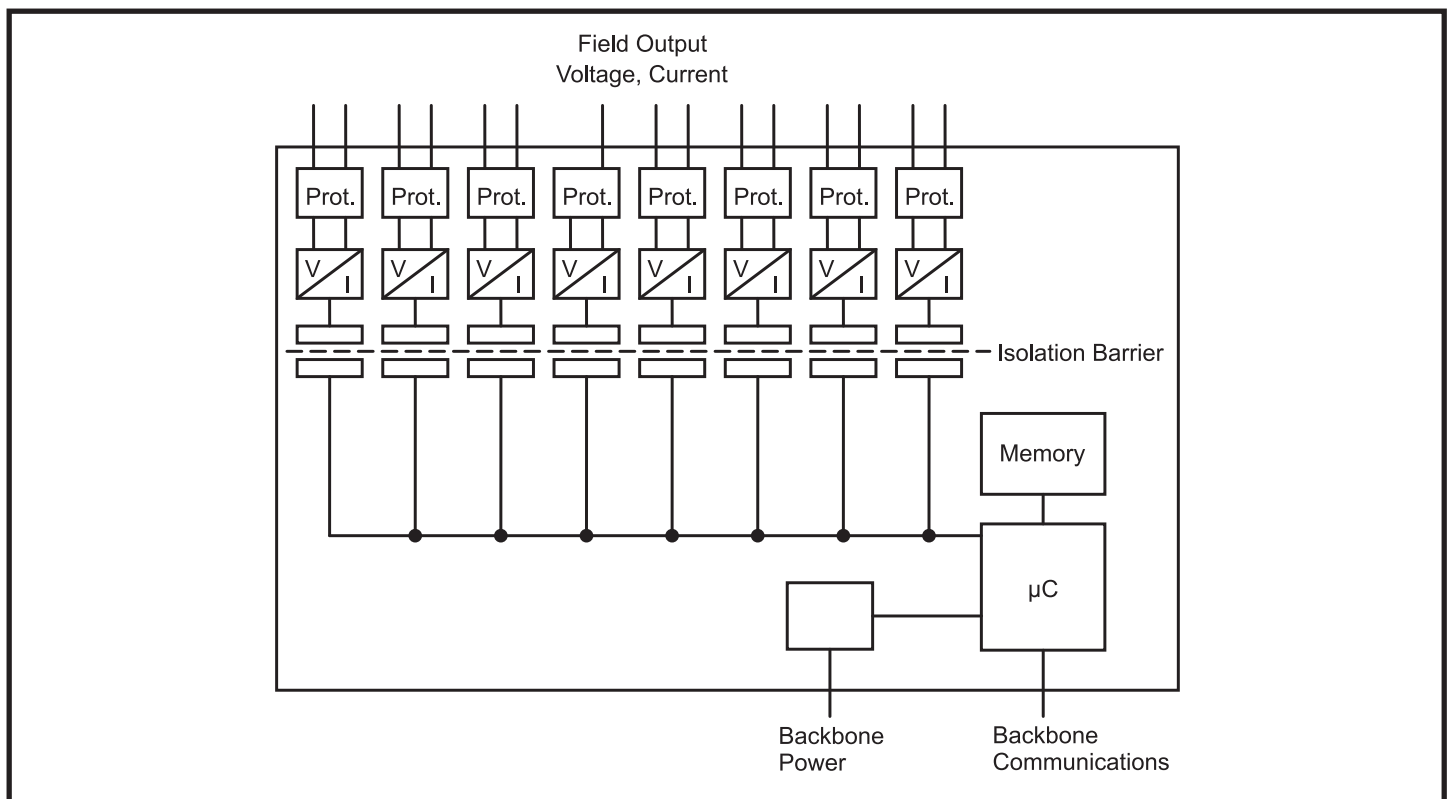- Selective Enabling of Module Channels for Refresh

Figure 1: MAQ20 Voltage & Current Output Module Block Diagram

Specifications
Typical* at T_A=+25°C and +24VDC system power

Module	Description
MAQ20-VO	8 Isolated Channel Voltage Output
	0-2.5V, 0-5V, 0-10V, ±2.5V, ±5V, ±10V (Default ±10V)
MAQ20-IO	8 Isolated Channel Current Output
	0-20mA, 4-20mA (Default 0-20mA)
Per Channel Setup	Individually configurable for range,
	default output, waveform
MAQ20-VO	
Output Drive (Max Load)	10mA (1000Ω at 10V)
Over-range	10.5V
MAQ20-IO	
Compliance	15VDC
Load Range	0-600Ω
Over-range	21.5mA
Current Limit	26mA
Output Protection	
Continuous	40Vrms max
Transient	ANSI/IEEE C37.90.1
CMV	
Channel-to-Bus	1500Vrms, 1 min
Channel-to-Channel	300Vrms
Transient	ANSI/IEEE C37.90.1
CMR	75dB at 50/60Hz
Accuracy[1]	±0.040% span
Linearity / Conformity	±0.030% span
Resolution	0.024% span
Stability	
Zero	±25ppm/C
Span	±35ppm/C
Bandwidth, –3dB	100Hz
Update Rate	1600 Ch/s
Power Supply Current	450mA at no-load, 650mA at full-load
Dimensions (h)(w)(d)	4.51" x 0.60" x 3.26" (114.6mm x 15.3mm x 82.8mm)
Environmental	
Operating Temperature	–40°C to +85°C
Storage Temperature	–40°C to +85°C
Relative Humidity	0 to 95% Noncondensing
Emissions, EN61000-6-4	ISM Group 1
Radiated, Conducted	Class A
Immunity EN61000-6-2	ISM Group 1
RF	Performance A ±0.5% Span Error
ESD, EFT	Performance B
Certifications	Heavy Industrial CE, ATEX Pending
	UL Class I, Division 2, Groups A, B, C, D Pending

NOTES:
* Contact factory or your local Dataforth sales office for maximum values.
(1) Includes conformity, hysteresis and repeatability.

Ordering Information

Model	Description
MAQ20-VO	Analog Output Module; Voltage, 8-ch
MAQ20-IO	Analog Output Module; Current mA, 8-ch

For output connections and full details on module operation, refer to MA1042 – MAQ20 Voltage and Current Output Module Hardware User Manual, available for download at: www.dataforth.com/maq20_download.aspx.

Discrete Input / Output Modules
5 Input Channels and 5 Output Channels (MAQ20-DIOL)
4 Input Channels and 4 Output Channels (MAQ20-DIOH)◇

Description

The MAQ20-DIOL discrete input/output module has 5 isolated discrete input channels and 5 isolated discrete output channels. Input channels accept 3-60VDC signals and output channels switch 3-60VDC signals at up to 3A load.

The MAQ20-DIOH◇discrete input/output module has 4 isolated discrete inputs and 4 isolated discrete outputs. Input channels accept 90-280VAC/VDC signals and output channels switch 24-280VAC signals at up to 3A AC load. NOTE: DIOH output channels switch AC loads only.

Discrete output channels have user configurable default output states which are set up on power up or module reset. In addition to performing standard discrete I/O, the channels can be configured to perform seven special functions: Pulse/Frequency Counter, Pulse/Frequency Counter with Debounce, Waveform Measurement, Time Between Events, Frequency Generator, Pulse Width Modulation (PWM), and One-Shot Generator. Up to four special functions can run simultaneously. High, Low, High-High and Low-Low alarms provide essential monitoring and warning functions to ensure optimum process flow and fail-safe applications. Field I/O connections are made through a pluggable terminal block.

Input-to-bus isolation is a robust 1500Vrms and channel-to-channel isolation is 300Vrms. Each individual channel has continuous overload and reverse connection protection in case of inadvertent wiring errors.

◇ Preliminary at date of printing. Contact factory for availability.

▶ Features

- Rugged Isolation and Protection for Industrial Control
- User-Defined Default Output and Output Waveform
- 7 High Performance Special Functions
- 1500Vrms Input-to-Bus Isolation
- 300Vrms Channel-to-Channel Isolation
- Continuous Overload and Reverse Protection

IMPORTANT: The DIOH module can only switch AC loads, not DC. The output switch is AC only with zero-crossing detection.
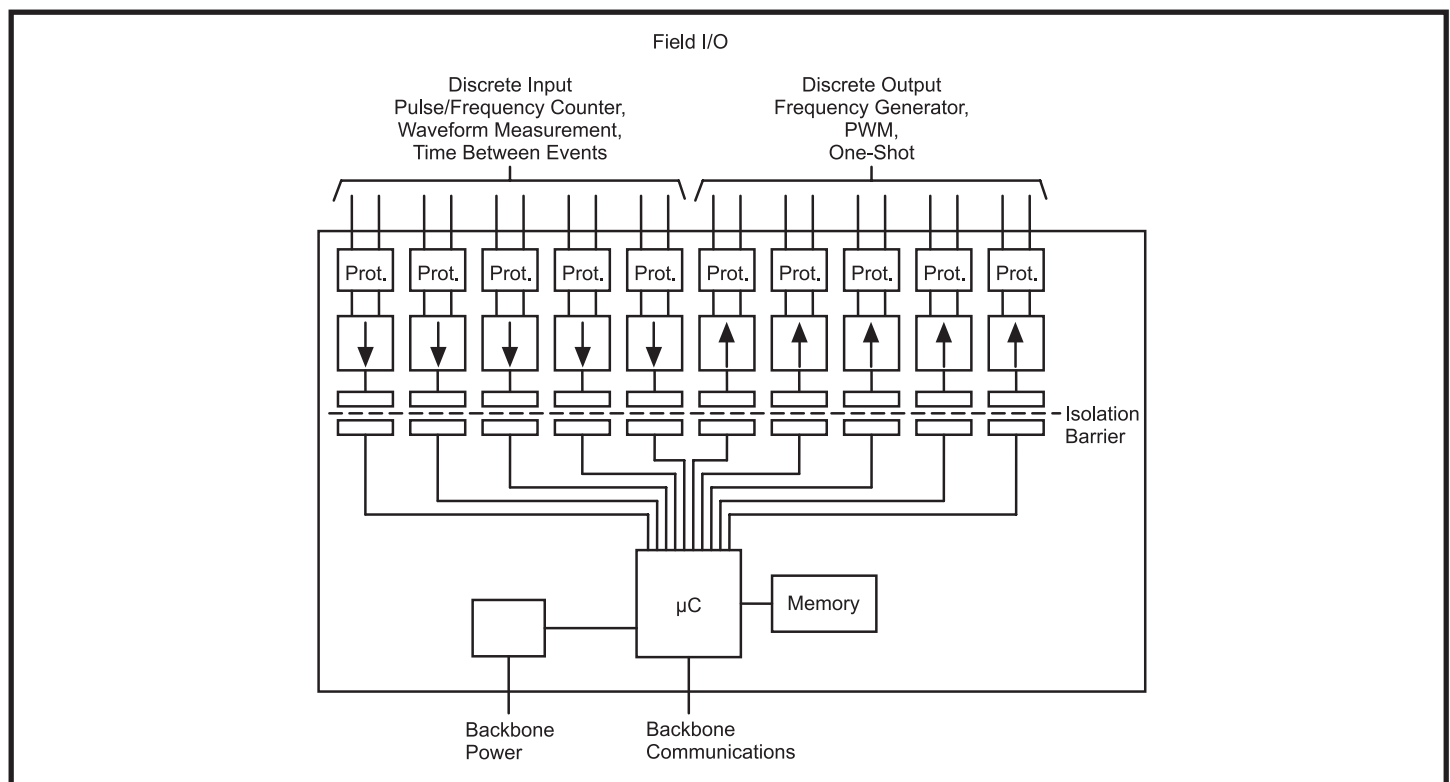

Figure 1: MAQ20-DIOL Discrete Input/Output Module Block Diagram

Specifications
Typical* at T_A=+25°C and +24VDC system power

Module	Description
MAQ20-DIOL	5 Isolated Channel Discrete Input, 3-60VDC
	5 Isolated Channel Discrete Output, 3-60VDC
MAQ20-DIOH◇	4 Isolated Channel Discrete Input, 90-280VAC/VDC
	4 Isolated Channel Discrete Output, 24-280VAC
Per Channel Setup	Individually configurable for default output, special function
Input Protection	
Continuous, -DIOL	70VDC max, Reverse Polarity Protected
Continuous, -DIOH	350VAC/VDC max
Transient	ANSI/IEEE C37.90.1
Output Protection	
Continuous, -DIOL	70VDC max, Reverse Polarity Protected
Continuous, -DIOH	350VAC/VDC max
Transient	ANSI/IEEE C37.90.1
CMV	
Channel-to-Bus	1500Vrms, 1 min
Channel-to-Channel	300Vrms, 425VDC
Transient	ANSI/IEEE C37.90.1
Output Load (Combined load, all channels)(1)	
MAQ20-DIOL	
Ta=25°C, Freq=0 to 1500Hz, Duty Cycle=5-100%	3A (2A if adjacent module Tcase>50°C)
Ta=85°C, Freq=0 to 500Hz, Duty Cycle=5-100%	2A (1A if adjacent module Tcase>50°C)
MAQ20-DIOH	
Ta=25°C, Freq=0 to 1500Hz	3Arms
Ta=85°C, Freq=0 to 500Hz	3Arms
Switching Characteristics	
MAQ20-DIOL	
Input Channel Turn-On/Turn-Off Time	25µs / 55µs
Output Channel Turn-On/Turn-Off Time	20µs / 40µs
MAQ20-DIOH	
Input Channel Turn-On/Turn-Off Time	20ms / 30ms (VAC), 1ms / 1ms (VDC)
Output Channel Response Time	0.5 Cycle
I/O Special Functions	
Pulse/Frequency Counter	Freq to 10kHz, Count to 10M, RPM to 65k
Pulse/Frequency Counter w/De-Bounce	Freq to 3kHz, Count to 10M
Waveform Measurement	Freq to 500Hz, # Periods, Pulse Width, Period, Duty Cycle
Time Between Events	Min, Max, Avg, Selectable Timebase
Frequency Generator	Up to 700Hz
PWM Generator	200µs min Period, Selectable Timebase
One-Shot Pulse Generator	100µs min, Programmable Pre- and Post-Delay
Scan/Update Rate	3500 Ch/s
Alarms	High / High-High / Low / Low-Low
Power Supply Current	30mA
Dimensions (h)(w)(d)	4.51" x 0.60" x 3.26" (114.6mm x 15.3mm x 82.8mm

Ordering Information

Model	Description
MAQ20-DIOL	Digital Input/Output Module; 3 to 60VDC In, 3 to 60VDC Out, 5-ch In, 5-ch Out
MAQ20-DIOH◇	Digital Input/Output Module; 90 to 280VAC/VDC In, 24 to 280VAC Out, 4-ch In, 4-ch Out

Specifications

Module	Description
Environmental	
Operating Temperature	−40°C to +85°C
Storage Temperature	−40°C to +85°C
Relative Humidity	0 to 95% Noncondensing
Emissions, EN61000-6-4	ISM Group 1
Radiated, Conducted	Class A
Immunity EN61000-6-2	ISM Group 1
RF	Performance A ±0.5% Span Error
ESD, EFT	Performance B
Certifications	Heavy Industrial CE, ATEX Pending UL Class I, Division 2, Groups A, B, C, D Pending

NOTES:
* Contact factory or your local Dataforth sales office for maximum values.
◇ Preliminary at date of printing. Contact factory for availability.
(1) See manual for detailed calculations of load ratings based on ambient temperature, multiple channels, and adjacent modules.

For input and output connections and full details on module operation, refer to MA1043 – MAQ20 Discrete Input-Output Module Hardware User Manual, available for download at: www.dataforth.com/maq20_download.aspx.

System Backbones
Distribute Power and Communications

Description

The MAQ20 system backbone resides within the DIN rail used for module mounting and provides power to and interface between the communications module and the I/O modules. Standard backbones provide for one communication module and 4, 8, 16, or 24 I/O modules. The longest backbone, which accommodates 24 I/O modules, fits in an industry standard 19" rack. Each backbone utilizes a pluggable connector system on each end such that varying system channel counts can be configured using the standard backbones. As a result of this pluggable system, the main part of a system, including the communications module, can be installed in one location while other sets of I/O modules installed in remote locations connect to the main system through a wire harness.

Modules mount on industry standard 35x7.5mm gull-wing DIN rails.

Once a system is established with a system backbone and a communications module, system configuration is accomplished by applying power and installing the I/O modules. These are hot swappable and true 'plug and run'. When an I/O module is plugged into any backbone position, the communications module automatically recognizes that it has been added to the system, registers it in the system configuration record, and makes it immediately available in the host software for use in data acquisition and control and test and measurement applications. Similarly, when a module is removed from any backbone position, the communications module recognizes that it has been unplugged, removes it from the system configuration, and disables it in the software.

▶Features

- Compact Mounting in DIN Rail Channel
- Distribute Power and Communications
- 4, 8, 16, and 24 Position Models
- Simplify System Wiring
- Expandable for Local or Distributed Installation
- Prevent Reverse Installation
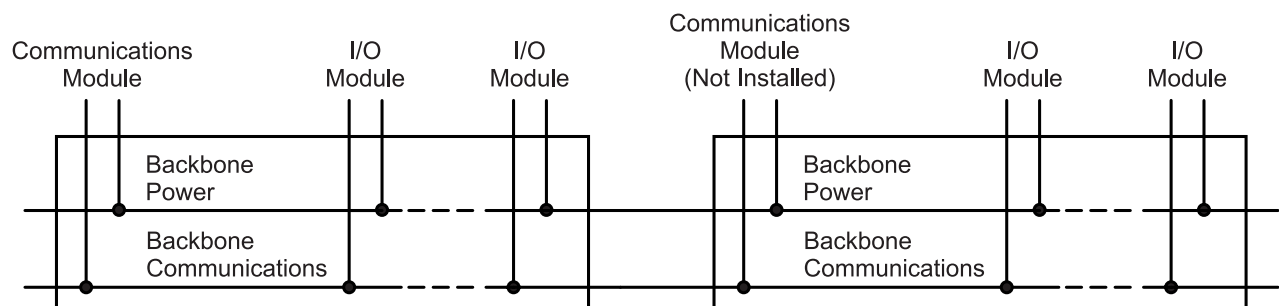- Long-Life, Durable, Vibration Resistant Contacts

Figure 1: MAQ20 Backbone Block Diagram

Specifications

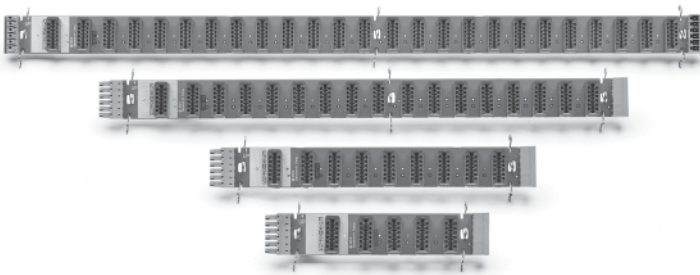| Module	Description
MAQ20-BKPL4	1 COM Module plus 4 I/O Modules
MAQ20-BKPL8	1 COM Module plus 8 I/O Modules
MAQ20-BKPL16	1 COM Module plus 16 I/O Modules
MAQ20-BKPL24	1 COM Module plus 24 I/O Modules

Expansion & Distributed Installation
  Mechanical
 	
  Expansion Distance
Mounting
  Physical
 	
  Reverse Protection
 	
Electrical
  Circuitry
  Inter-Module Communications
	Male/Female pluggable terminal blocks at each end of the backbone allow direct interconnection or remote installation using the accessory expansion cable.
	100ft (30m) max
	
	Spring clips hold the backbone in the DIN rail. When modules are installed, the backbone is secured to the DIN rail. Mechanical interface prevents reverse module installation.
	
	Passive
	RS-485

Dimensions (h)(w)(d)
  MAQ20-BKPL4
  MAQ20-BKPL8
  MAQ20-BKPL16
  MAQ20-BKPL24
	5.05" x 0.94" (127.1mm x 3.9mm)
	7.53" x 0.94" (191.1mm x 3.9mm)
	12.63" x 0.94" (320.9mm x 3.9mm)
	17.41" x 0.94" (442.1mm x 3.9mm)

Environmental
  Operating Temperature
  Storage Temperature
  Relative Humidity
	−40°C to +85°C
	−40°C to +85°C
	0 to 95% Noncondensing

Certifications	Heavy Industrial CE, ATEX Pending UL Class I, Division 2, Groups A, B, C, D Pending

Ordering Information

Model	Description
MAQ20-BKPL4	DIN Rail Backbone; 1 COM Module plus 4 I/O Modules
MAQ20-BKPL8	DIN Rail Backbone; 1 COM Module plus 8 I/O Modules
MAQ20-BKPL16	DIN Rail Backbone; 1 COM Module plus 16 I/O Modules
MAQ20-BKPL24	DIN Rail Backbone; 1 COM Module plus 24 I/O Modules

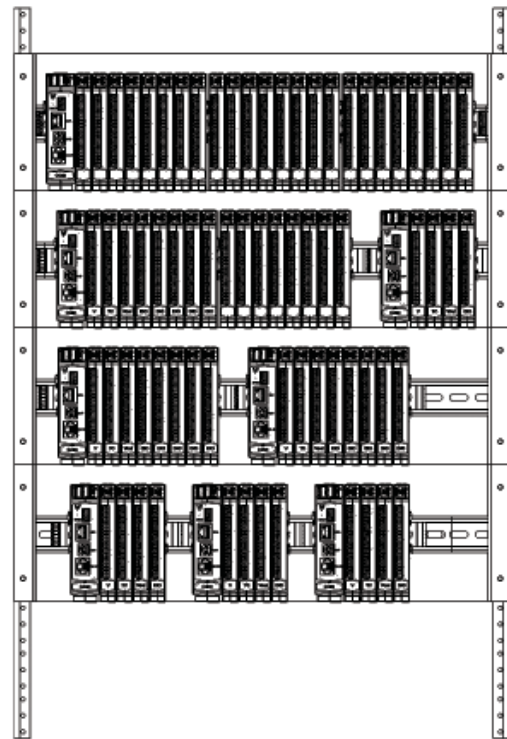Figure 3: Flexible Backbone System Allows Configuration with Communications Module and 4, 8, 16, or 24 I/O Modules in 19" Rack Space

Figure 2: MAQ20 Backbones for 4, 8, 16, and 24 I/O Modules

For connections and full details on system operation, refer to MA1040 – MAQ20 Communications Module Hardware User Manual, available for download at: www.dataforth.com/maq20_download.aspx.

MAQ20-940/-941/-945

ReDAQ® Shape and Configuration Software for MAQ®20

Description

Dataforth offers ReDAQ® Shape software for MAQ20 as an easy and efficient development tool for use with the MAQ®20 Industrial Data Acquisition and Control System. This out-of-the-box software enables users to create, save, and open graphical user interface projects for test, process, data collection and data analysis applications. Built-in functions in the Acquire and Analyze panels are pre-configured and can be used as is. Just three easy steps are required to create data acquisition and control projects in the Presentation panel using 18 high quality tools and powerful MAQ20 functions.

ReDAQ Shape for MAQ20 is ideal for data acquisition, monitoring and control applications. It enables users to easily interact with the Dataforth PID loop controller, which an engineer or operator accesses through faceplates within the software.

The ReDAQ Shape software also provides an effective way to configure and customize MAQ20 functions for specific application requirements. The toolbox tools are easily moved, re-sized, cut, copied, pasted, and deleted. The main screen of ReDAQ Shape shows a representation of the system inclusive of the communication module and any installed I/O modules. This graphic is updated as I/O modules are added to or removed from the system. Modules can be given unique identifiers, and I/O module channels can be assigned tag names to represent process variables they control.

Based on programming tools incorporated from Microsoft Visual Studio® and National Instruments Measurement Studio™, ReDAQ Shape software for MAQ20 has a very short user-learning curve and offers integrated, across-the-board applicability for data acquisition and control applications.

▶ Features

• 3 Easy Steps to Create Customized Presentation Panels
• No Setup or Configuration Required in Acquire and Analyze Panels
• Faceplates for PID Loop Control
• 18 High Quality Toolbox Tools
• Supports Any Graphical File Format
• Integrated, Across-the-Board Applicability
• Most Effective Way to Set Up & Configure MAQ®20 Functions:
  - Continuous acquisition and burst scan modes
  - Automatically scales data from counts to engineering units
  - Discrete I/O offers 7 special functions: pulse frequency counter, pulse/frequency counter with de-bounce, waveform measurement, time between events, frequency generator, PWM generator, one-shot pulse generator
  - Assign tag names for any input and output
  - Configure control loops and alarm outputs
  - Three function timer (count-down, 24hr/day, day/time) with 10 programmable events

Figure 1: ReDAQ Shape Software Screen Shots

PID Loop Control
in ReDAQ® Shape Software for MAQ®20

Description

The powerful Dataforth MAQ20 communications module is capable of autonomously running up to 32 PID control loops; faceplates within ReDAQ Shape software enable an engineer or operator to configure the many features of loop control and monitor processes.

With proportional and derivative modes that can act on error or a process variable, the controller can eliminate process bumps from set point changes. Gap control provides improved loop stability near the set point while retaining high response speed. The ability to change tuning settings without disturbing the process when the controller is in automatic mode and the option to track the set points of process variables during manual operation are both key features that enable smooth operation in both manual and automatic modes.

To ensure sensitive equipment is well protected, the controller's output range can be limited. The anti-reset windup feature both minimizes overshoot and improves stability after output saturation conditions.

The integrated auto tuner simplifies the complex task of control loop tuning with separate methods for integrating and self-regulating loops.

Typical PID Applications
• Steam, water, and chemical flow control
• Tank level control
• Heat-exchanger / reactor temperature control
• Pressure control

There is no limit to the types of processes that can be controlled with the Dataforth PID controller, and its features are paralleled only by state-of-the-art distributed control systems.

► Features

• Separate Panels for Setting Basic, Advanced, and Alarm Items
• Noninteracting and Parallel PID Control Algorithms
• Up to 32 Loops of PID Control
• Controller Runs in Real Time
• Controller Accessed through Faceplates
• Proportional and Derivative Modes can Act on Error or Process Variable
• Gap Control
• Built-in Process Variable Filtering
• Bumpless Manual to Automatic Control Mode Transfer
• Change Tuning Settings Easily in Automatic Mode
• Optional Process Variable Set Point Tracking in Manual Mode
• Limit Controller Output Range
• Anti-reset Windup
• Four Process Alarms
• Full-featured Faceplate for Numeric and Visual Feedback
• Integrated Auto Tuner

Ordering Information

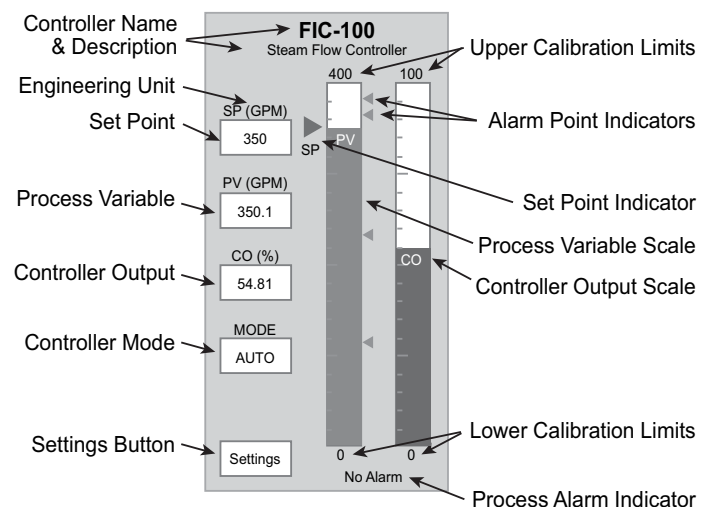| Model	Description
MAQ20-940	ReDAQ Shape Software for MAQ20 Developer Version
MAQ20-941	ReDAQ Shape Software for MAQ20 User Version
MAQ20-945	MAQ20 Configuration Software Tool

Figure 2: PID Faceplate in ReDAQ Shape Software

MAQ20-951/-952

IPEmotion Software for MAQ®20

Description

Representing the next step in test and measurement, IPEmotion is a very advanced, intuitive, versatile, and high performance data acquisition / test and measurement software designed specifically for industrial and R&D applications. Now available for the MAQ20, this powerful new generation software provides synchronized data acquisition and is easily adaptable to all customer specific requirements.

These requirements can include device configuration, data acquisition measurement, visualization, and analysis; to meet them, IPEmotion provides automatic recognition of connected devices, automatic configuration of all channels, automatic start of measuring, and instant visualization of all measurement values.

MAQ20 / IPEmotion measurements include temperature, current and voltage, strain, pressure, frequencies and rotational speeds, and logging and diagnostic data.

To enhance ease of use and increase productivity, the versatile IPEmotion is available in seven languages: English, German, French, Italian, Chinese (traditional and simplified), Korean, and Japanese. Russian and other languages will be available in the near future.

PID loop control is an integral part of IPEmotion. It runs in Windows and an unlimited number of loops are possible; the only limiting factor is the processing power of the PC.

IPEmotion communicates with the MAQ20 via a Plug-In driver. The software also enables many functions to be integrated by linking external .dll and Visual Basic Script (.VBS) files to the application. This is a powerful tool, as Script enables users to automate the measurement process and to change menus, settings, analyzing procedures, and other aspects of the software.

Well designed for long-term measurements, IPEmotion allows measurement analysis and verification during data acquisition. Storage can be on a local hard drive or a remote drive, including a mapped Internet or network drive.

▶ Features

- Live Data Display, Recording, Online and Offline Math and Logic Functions
- One-Click Acquisition
  - Direct hardware detection, data display and recording
- Live Adjustment
  - Analyze and verify measurements during active data acquisition
  - GUI adaptation during active measurement and storage
- Data Analysis
- PID Loop Control
- Post Processing and Report Generation
- Easy Drag and Drop
- High Speed Recording
- Plug-In Synchronization
- Import and Export Recorded Data to Standard File Formats
- Scripting Option
- Configurable Gauges for Wide Ranging Applications
- Multilingual

Figure 1: IPEmotion Software Screen Shots

PID Loop Control
in IPEmotion Software for MAQ®20

Description

PID loop control is extensive and highly functional in the IPEmotion software. An unlimited number of loops can be run; the only limiting factor is the processing power of the PC.

A maximum calculation cycle time update rate of 1kHz allows the software to control processes with fast reacting elements.

Typical PID Applications

- Steam, water, and chemical flow control
- Tank level control
- Heat-exchanger / reactor temperature control
- Pressure control

▶ Features

- Control Module Includes PID, State Machine, Function Generator, Math Functions
- Unlimited PID Control Loops Possible
- PID Controller Runs in Windows
- Start, Stop, Hold Trigger for All Control Functions
- Designed for Test Sequencing and Test Bench Control Operations
- 1kHz Maximum Calculation Cycle Time Update Rate
- Easily Configured Test Sequences using VBS or Phyton Scripts
- Configure with Point and Click Functions on IPEmotion GUI
- Software Usable as Virtual PLC

Ordering Information

Model	Description
MAQ20-951	IPEmotion Software for MAQ20 (1 COM module and 1 to 4 I/O modules)
MAQ20-952	IPEmotion Software for MAQ20 (Each additional 4 I/O modules)

Accessories
Expansion Cables and Boost Power Supply Module

Description

Accessories for the MAQ®20 Industrial Data Acquisition and Control System include backbone expansion cables and a boost power supply module for systems that have power supply requirements greater than those the communications module provides.

Cables to interface 8B backpanels to the MAQ20-VSN module are also available.

A MAQ20 Demonstration Suitcase with process simulator is offered to sales channels.

Ordering Information

Backbone Expansion Cables

Model	Description
MAQ20-XCA-01	Backbone Expansion Cable; 1 meter
MAQ20-XCA-02	Backbone Expansion Cable; 2 meter

Boost Power Supply Module◇

Model	Description
MAQ20-PWR3	Boost Power Supply Module

Cables to Interface 8B Backpanels to MAQ20-VSN Module

Model	Description
MAQ20-8B25-0.3	DB25-to-20 pos screw term Transition Cable, 0.3m long
MAQ20-8B25-0.6	DB25-to-20 pos screw term Transition Cable, 0.6m long
MAQ20-8B25-01	DB25-to-20 pos screw term Transition Cable, 1.0m long

MAQ20 Demonstration Suitcase

Model	Description
MAQ20DEMO-B	MAQ20 Demonstration Suitcase with Process Simulator for Sales Channels

◇ Preliminary at date of printing.
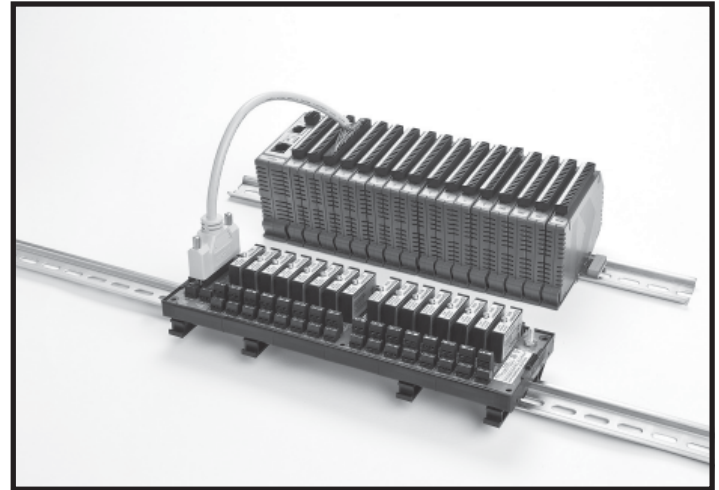 Contact factory for availability.

Figure 1: Cable Interfacing 8B Backpanel to MAQ20-VSN Module

Figure 2: Backbone Expansion Cable

Figure 3: MAQ20 Demonstration Suitcase

DATAFORTH WARRANTY
Applying to Products Sold by Dataforth Corporation

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i. for all software products including licensed programs, thirty (30) days from date of initial delivery;

ii. for all hardware products including complete systems, one (1) year from date of initial delivery;

iii. for all special products, sixty (60) days from date of initial delivery; and

further, all products warranted hereunder for which Dataforth has received timely notice of nonconformance must be returned FOB to Dataforth's plant in Tucson, Arizona USA within thirty (30) days after the expiration of the warranty periods set forth above.

The foregoing warranties shall not apply to any products which Dataforth determines have, by buyer or otherwise, been subjected to operating and/or environmental conditions in excess of the maximum value established therefor in the applicable specifications, or any products that have been the subject of mishandling, misuse, misapplication, neglect, improper testing, repair, alteration or damage. THE PROVISIONS OF THE FOREGOING WARRANTIES EXTEND TO BUYER ONLY AND NOT TO BUYER'S CUSTOMERS OR USERS OF BUYER'S PRODUCTS. THE DATAFORTH STANDARD WARRANTY IS IN LIEU OF ALL WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE OR USE AND ALL OTHER WARRANTIES WHETHER EXPRESS, IMPLIED OR STATUTORY, EXCEPT AS TO TITLE. THE DATAFORTH STANDARD WARRANTY MAY BE CHANGED BY DATAFORTH WITHOUT NOTICE.

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c. **Limitation on Damages.**

(1) IN NO EVENT SHALL DATAFORTH, ITS SUPPLIERS, LICENSORS, SERVICE PROVIDERS, EMPLOYEES, AGENTS, OFFICERS, AND DIRECTORS BE LIABLE FOR INDIRECT, SPECIAL, INCIDENTAL, COVER, ECONOMIC, PUNITIVE, ACTUAL, EXEMPLARY, CONSEQUENTIAL OR OTHER DAMAGES OF ANY NATURE INCLUDING, WITHOUT LIMITATION, LOST PROFITS OR REVENUES, COSTS OF REPLACEMENT PRODUCTS, LOSS OR DAMAGE TO DATA ARISING OUT OF THE USE OR INABILITY TO USE ANY DATAFORTH PRODUCT.

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d. **Technical Assistance.** Dataforth's Warranty as hereinabove set forth shall not be enlarged, diminished or affected by, and no obligation or liability shall arise or grow out of, Dataforth's rendering of technical advice, facilities or service in connection with buyer's order of the products furnished hereunder.

e. **Warranty Procedures.** Buyer shall notify Dataforth of any products which it believes to be defective during the applicable warranty period and which are covered by the Warranty set forth above. Buyer shall not return any products for any reason without the prior authorization of Dataforth and issuance of a Return Material Authorization ("RMA") number. After issuance of a RMA number, such products shall be promptly returned by buyer (and in no event later than thirty (30) days after the Warranty expiration date), transportation and insurance prepaid, to Dataforth's designated facility for examination and testing. Dataforth shall either repair or replace any such products found to be so defective and promptly return such products to buyer, transportation and insurance prepaid. Should Dataforth's examination and testing not disclose any defect covered by the foregoing Warranty, Dataforth shall so advise buyer and dispose of or return the products in accordance with buyer's instructions and at buyer's sole expense, and buyer shall reimburse Dataforth for testing expenses incurred at Dataforth's then current repair rates.

f. **Repair Warranty.** Dataforth warrants its repair work and/or replacement parts for a period of ninety (90) days from receipt by buyer of the repaired or replaced products or for the remainder of the warranty period for the initial delivery of such order as set forth in paragraph a above, whichever is greater.

g. **Critical Applications.** Certain applications using Dataforth's products may involve potential risks of death, personal injury, or severe property or environmental damage ("Critical Applications"). DATAFORTH'S PRODUCTS ARE NOT DESIGNED, INTENDED, AUTHORIZED, OR WARRANTED TO BE SUITABLE FOR USE IN LIFE-SUPPORT DEVICES OR SYSTEMS, SAFETY EQUIPMENT, NUCLEAR FACILITY APPLICATIONS OR OTHER CRITICAL APPLICATIONS WHERE MALFUNCTION OF THE PRODUCT CAN BE EXPECTED TO RESULT IN PERSONAL INJURY, DEATH OR SEVERE PROPERTY DAMAGE. BUYER USES OR SELLS SUCH PRODUCTS FOR USE IN SUCH CRITICAL APPLICATIONS AT BUYER'S OWN RISK AND AGREES TO DEFEND, INDEMNIFY AND HOLD HARMLESS DATAFORTH FROM ANY AND ALL DAMAGES, CLAIMS, PROCEEDINGS, SUITS OR EXPENSE RESULTING FROM SUCH USE.

h. **Static Sensitive.** Dataforth ships all product in anti-static packages. Dataforth's Warranty as hereinabove set forth shall not cover warranty repair, replacement, or refund on product or devices damaged by static due to buyer's failure to properly ground.

Application Support

Dataforth provides timely, high-quality product support. Call **1-800-444-7644 TOLL-FREE**

Returns/Repair Policy

All warranty and repair requests should be directed to the Dataforth Customer Service Department at (520) 741-1404. If a product return is required, request a Return Material Authorization (RMA) number. You should be ready to provide the following information:

1. Complete product model number.
2. Product serial number.
3. Name, address, and telephone number of person returning product.
4. Special repair instructions.
5. Purchase order number for out-of-warranty repairs.

The product should be carefully packaged, making sure the RMA number appears on the outside of the package, and shipped prepaid to:

Dataforth Corporation
6230 S. Country Club
Tucson, AZ 85706 USA

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DATAFORTH®

High Performance Industrial Signal Conditioning, Data Acquisition & Control, and Data Communication Products Since 1984

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