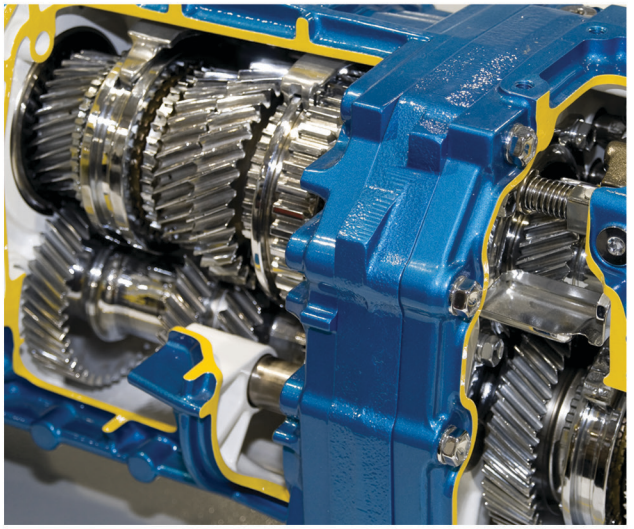
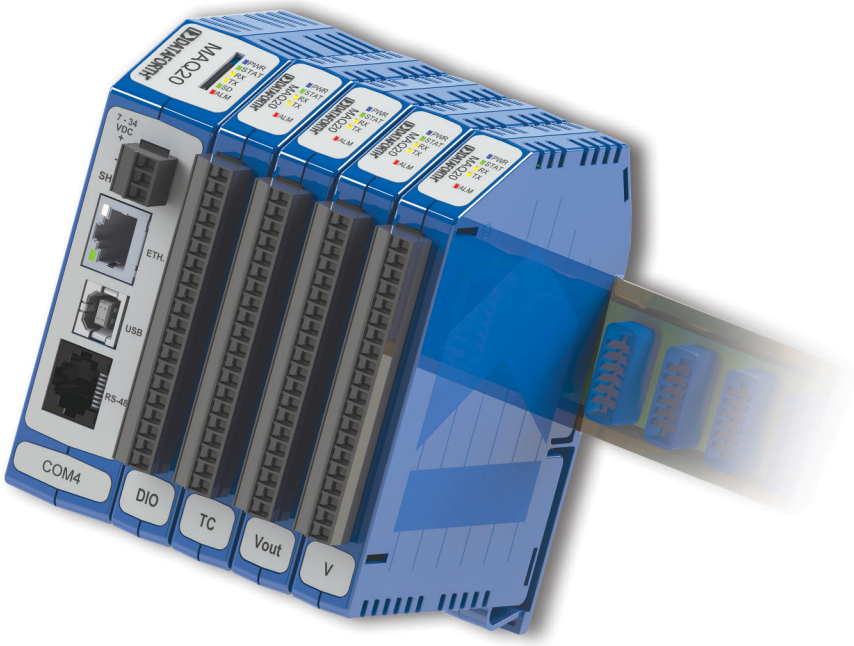


MAQ®20

Industrial Data Acquisition & Control System

- ✔ Test and Measurement
- ✔ Factory and Process Automation
- ✔ Machine Automation
- ✔ Military and Aerospace
- ✔ Power and Energy
- ✔ Environmental Monitoring
- ✔ Oil and Gas



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DATAFORTH®

ETHERNET USB RS-232 RS-485 Modbus

Flexible, Powerful, High Performance...

MAQ®20 Industrial Data Acquisition & Control System

The MAQ®20 Industrial Data Acquisition and Control System encompasses more than 25 years of design excellence and quality in the process control industry. The initial offering in this high performance and highly flexible system is a family of DIN rail mounted, programmable, multi-channel, industrially rugged signal conditioning input and output modules and communication modules. Each I/O module has a 1500Vrms isolation barrier between field-side and system-side wiring, and some 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 communication modules and each I/O module. One communication 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.

The Modules

- **Communication Modules:** Offered in Ethernet, RS-232, RS-485, and USB with host software interfaces 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
  - **Process Voltage, Process Current & Thermocouple Input Modules** offer 8-channel differential input or 16-channel single-ended input for precise measurement of voltage and current signals; they also offer 8-channel measurement of five thermocouple types including accurate cold junction compensation and linearization. All channels are individually configurable for range, alarm limits, and averaging.
  - **RTD 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 that offer four channels; each channel is configurable for range, alarm limits, averaging, bandwidth, excitation V, gain, shunt cal resistors, and sample rate.
  - **Frequency Input Module** accepts zero-crossing and TTL signals with frequencies of 500Hz to 100kHz and provides a DC stimulus for contact sensors. This module has four channels, each configurable for range and alarm limits.
- **Analog Output Modules: Process Current** and **Voltage Output** models 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 communication module and the I/O modules.

PID Loop Control

The PID controller runs in real time and features faceplates within ReDAQ® Shape software through which an engineer or operator can interact with the controller. ReDAQ® Shape also provides time-trends for monitoring the controller and process over time. An auto tuner feature simplifies the complex task of control loop tuning.

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.

Typical Applications

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

Key Features

- Separate panels for setting Basic, Advanced, and Alarm items
- Noninteracting and parallel PID control algorithms
- Proportional and derivative modes that can act on error or a process variable to eliminate process bumps from set point changes
- Gap control to improve control loop stability near the set point but retain high response speed
- Built-in process variable filtering
- Bumpless transfer from manual to automatic control mode
- Ability to change tuning settings with the controller in automatic control mode without disturbing the process
- Optional set point tracking of process variable during manual operation to facilitate smooth transition to automatic control mode
- Limiting of controller output range to protect sensitive equipment
- Anti-reset windup to minimize overshoot and improve stability after output saturation conditions
- Four process alarms to warn operators of abnormal process conditions
- Full-featured faceplate for numeric and visual feedback of key control loop parameters and simplified operator interaction
- Integrated auto tuner to simplify complex task of control loop tuning with separate methods for integrating and self-regulating loops

Key MAQ®20 Features

- **Wide Operating Temperature, –40°C to +85°C**
- **1500Vrms Channel-to-Bus Isolation**
- **240Vrms Continuous Input Protection**
- **ANSI/IEEE C37.90.1 Transient Protection**
- **Graphical Control Software**

Key MAQ®20 Functions

– Continuous acquisition and burst scan modes

– Automatically scales data from counts to engineering units

– Discrete I/O offers special functions: pulse/frequency counter, pulse/frequency counter with de-bounce, waveform measurement, time between events, frequency generator, PWM generator, and 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, or day/time) with 10 programmable events

Communication Modules are offered in two models covering standard industrial buses: Ethernet, RS-232, RS-485, and USB. Host software interfaces to the system using the Modbus TCP or RTU protocol. 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. Another useful feature of the system is the capability to store acquired data locally for later analysis. Each communication module has an easily accessible and removable 4GB micro-SD memory card that can be used to log data from all input modules.

To power the system, a 7-34VDC power source is connected to the communication module. Regulated and protected supplies within the module then provide power both to the internal circuits and to all modules in the system. When many high power I/O modules are used in a system, MAQ®20-PWR3 load-sharing power boost modules can be installed in standard I/O module slots to provide the necessary additional power.

Specifications: Communication Modules

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

Model Number	
MAQ20-COM4	Ethernet, USB, RS-485
MAQ20-COM2	Ethernet, USB, RS-232
Communications	
Ethernet	10/100 Base-T, RJ-45, Modbus TCP
USB	USB 2.0, Type B, Proprietary Modbus over USB
RS-485	4-wire, up to 921.6kbps, RJ-12, Modbus RTU
RS-232	up to 921.6kbps, RJ-12, Modbus RTU
Isolation	
Power and Communication Ports to Bus	30Vrms
Power Supply	
Input Power	7-34VDC at 2A max
Power to Bus	5VDC at 3A max

Common MAQ®20 Features

I/O Field Connection	Pluggable or spring cage terminal blocks (I/O module-dependent), 16-28 AWG
Failsafe Features	Watchdog Timer and Brownout Detection: Reset to user defined configuration
Dimensions (h)(w)(d)	
I/O Modules	4.51" x 0.60" x 3.26" (114.6mm x 15.3mm x 82.8mm)
Communication Module	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 ±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
Burn-in Qualification	48 hours at 85°C, powered and loaded

Communication Module

Analog Input Modules interface to a wide range of standard industrial sensors and equipment, including volt, millivolt, milliamp, thermocouple, RTD, potentiometer, strain gage and frequency. Four to 16 channels of input on the modules results in physically small control systems and low cost per channel. Signal ranges are user selectable and offered in both differential and single-ended configurations. Channels can be independently configured and alarms can be set to match the most demanding applications.

Specifications: Process Voltage, Process Current & Thermocouple Input Modules

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

Model Number	Description
MAQ20-MVDN	8-ch, mV, differential input ±2.0V, ±1.0V, ±250mV, ±100mV, ±50mV
MAQ20-VDN MAQ20-VSN	8-ch, V, differential input 16-ch, V, single-ended input ±60V, ±40V, ±20V, ±10V, ±5V
MAQ20-IDN MAQ20-ISN	8-ch, mA, differential input 16-ch, mA, single-ended input 0-20mA or 4-20mA
MAQ20-JTC	8-ch, TC, Type J –100°C to +760°C, 3 selectable ranges
MAQ20-KTC	8-ch, TC, Type K –100°C to +1350°C, 3 selectable ranges
MAQ20-TTC	8-ch, TC, Type T –100°C to +400°C, 2 selectable ranges
MAQ20-RSTC	8-ch, TC, Type R and Type S 0°C to +1750°C, 2 selectable ranges for R 2 selectable ranges for S
Per Channel Setup	Individually configurable for range, alarm limits, averaging
CMR	100dB at 50Hz or 60Hz
Isolation Channel-to-Bus	1500Vrms
NMR	30dB at 50Hz or 60Hz
Accuracy(1) mV, V, mA Input TC Input	 ±0.035% Span ±0.06% Span
Bandwidth	3Hz
Scan Rate	200 Ch/s
Alarms	High / High-High / Low / Low-Low
Open Input Response TC Input	 Upscale, Flag set
Cold Junction Compensation Accuracy, +25°C	 ±0.25°C
Power Supply Current	30mA

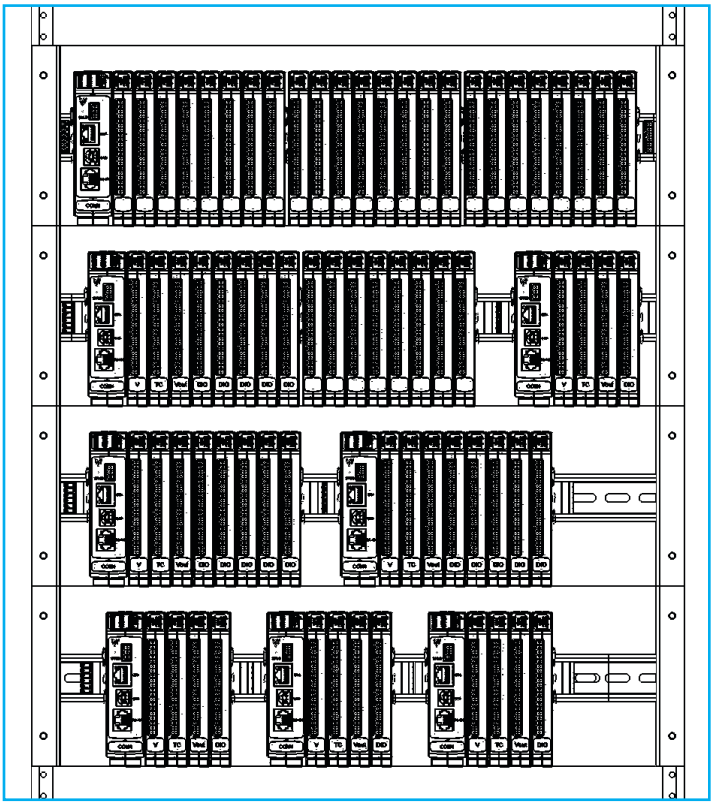
(1) Includes linearity/conformity, hysteresis and repeatability. Does not include CJC accuracy.

Specifications: 2- or 3-Wire RTD & Potentiometer Input Modules

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

Model Number	
MAQ20-RTD31	–200°C to +850°C (100Ω Pt, α = 0.00385) 3 selectable ranges –200°C to +850°C (100Ω Pt, α = 0.00392) 3 selectable ranges –80°C to +300°C (120Ω Ni, α = 0.00672) 3 selectable ranges 0Ω to 5kΩ (Potentiometer), 3 selectable ranges
MAQ20-RTD32	–200°C to +850°C (500Ω Pt, α = 0.00385) 3 selectable ranges –200°C to +850°C (1000Ω Pt , α = 0.00385) 3 selectable ranges 0°C to +160°C (10Ω, α = 0.004274 Cu) 0°C to +160°C (50Ω, α = 0.004274 Cu)
Number of Channels	6
Per Channel Setup	Individually configurable for range, alarm limits, averaging
CMR	100dB at 50Hz or 60Hz
Isolation Channel-to-Bus	1500Vrms
NMR	20dB at 50Hz or 60Hz
Accuracy(1)	±0.06% Span
Bandwidth	3Hz
Scan Rate	200 Ch/s
Alarms	High / High-High / Low / Low-Low
Open Input Response	Upscale or Downscale
Power Supply Current	40mA

(1) Includes conformity, hysteresis and repeatability.



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

Specifications: Strain Gage Input Module - Preliminary

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

Model Number MAQ20-BRDG1	 Full, Half, Quarter bridge; 4- or 6-wire
Number of Channels Per Channel Setup	4, isolated ch-to-ch Bandwidth, excitation V, gain, resistance range, shunt cal R, alarm limits, averaging, sample rate
Input Range Excitation Sensitivity	± 5mV to ±100mV 1.0V, 2.5V, 3.33V, 5V, 10V 2, 3, 5, 10mV/V
CMR Isolation Channel-to-Channel Channel-to-Bus	100dB at 50Hz or 60Hz 300Vrms 1500Vrms
Accuracy(1)	±0.03%
Bandwidth Sample Rate Alarms ADC	4Hz, 5kHz, 10kHz, 20kHz Up to 50k samples/second, simultaneous option, 128MByte buffer memory High / High-High / Low / Low-Low 24 bit Delta/Sigma per channel
Resistance Range Shunt Cal R	100 to 5kΩ 20k, 40k, 80k, 200kΩ

(1) Includes linearity/conformity, hysteresis and repeatability.

Specifications: Frequency Input Module - Preliminary

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

Model Number MAQ20-FREQ	 500Hz to 100kHz
Number of Channels Per Channel Setup	4 Individually configurable for range, alarm limits
Zero Crossing Input Min/Max Input Hysteresis Min Pulse Width TTL Input Min/Max Input Hysteresis Min Pulse Width Excitation	 100mVp-p/170Vp-p ±50mV 4µs 0.8V/2.4V 1.5V 4µs +5V at 8mA
CMR Isolation Channel-to-Bus	100dB at 50Hz or 60Hz 1500Vrms
Accuracy(1)	±0.05% Span
Scan Rate Alarms Power Supply Current	1500 Ch/s High / High-High / Low / Low-Low 30mA

(1) Includes linearity/conformity, hysteresis and repeatability.

Analog Output Process Current and Voltage Output Modules

Analog Output Process Current and Voltage Output Modules are offered with 4-20mA and 0-20mA process current output or up to ±10V voltage output with drive capability; they control motors, drive valves and perform many other crucial process operations. Up to eight channels of output on the modules results in physically small control systems and low cost per channel. Output modules have each field-side channel galvanically isolated from all others to eliminate common mode signal problems and offer maximum durability. Signal ranges are user selectable and channels can be independently configured to match the most demanding applications. Processing power within each module allows users to enter waveshapes to output to field devices. Power-on delay and configurable default channel states guarantee proper process performance upon startup and during power interruptions.

Specifications: Analog Output Modules

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

Model Number MAQ20-IO MAQ20-VO	 0-20mA or 4-20mA 0-10V, 0-5V, 0-2.5V, ±10V, ±5V, ±2.5V
Number of Channels Per Channel Setup Over-range MAQ20-IO MAQ20-VO Compliance MAQ20-IO Load Resistance Range MAQ20-IO Current Limit MAQ20-IO Output Drive (Max Load) MAQ20-VO Output Protection Continuous Transient	8, isolated ch-to-ch Individually configurable for range, default output, waveform 21.5mA 10.5V 15V 0 to 600Ω 26mA 10mA (1000Ω at 10V) 40Vrms max ANSI/IEEE C37.90.1
CMR Isolation Channel-to-Channel Channel-to-Bus	75dB at 50Hz or 60Hz 300Vrms 1500Vrms
Accuracy(1)	±0.04% Span
Bandwidth Update Rate Output Waveform Waveform Definition Update Rate Power Supply Current	100Hz 1600 Ch/s 100 points per channel 10ms for 8-ch 450mA

(1) Includes linearity/conformity, hysteresis and repeatability.

Discrete Input/Output Modules have multiple channels of input and output per module. Solid state circuits provide or interface to discrete signals up to 60V and 3A. In addition to standard discrete I/O, these modules provide advanced special functions including Pulse/Frequency Counter with or without de-bounce, Waveform Measurement, Time Between Events, Frequency Generator, PWM Generator, and One-Shot Pulse Generator. Alarms can be set on the discrete input channels.

Specifications: Discrete Input/Output Modules

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

Model Number	
MAQ20-DIOL	3 to 60 VDC input 3 to 60 VDC output, 3A
MAQ20-DIOH	90 to 280 VAC/VDC input 24 to 280 VAC output, 3A
Number of Channels	4 or 5, isolated ch-to-ch
MAQ20-DIOL	5 discrete input, 5 discrete output
MAQ20-DIOH	4 discrete input, 4 discrete output
Per Channel Setup	Individually configurable for special function, default output
Input Protection (Discrete Input Channels)	
Continuous	70VDC max, reverse polarity protected
Transient	ANSI/IEEE C37.90.1
Output Protection (Discrete Output Channels)	
Continuous	70VDC max, reverse polarity protected
Transient	ANSI/IEEE C37.90.1
Isolation	
Channel-to-Channel	300Vrms
Channel-to-Bus	1500Vrms
I/O Special Functions	
Pulse/Frequency Counter	Freq to 10kHz, count to 10M, RPM to 65k
Pulse/Frequency Counter with De-bounce	Freq to 3kHz, count to 10M
Waveform Measurement	Freq to 500Hz at 1% accuracy, 10kHz at 14% accuracy; # periods, pulse width, period, duty cycle
Time Between Events	Min, max, avg, selectable timebase
Frequency Generator	Up to 700Hz at 1% accuracy, 10kHz at 14% accuracy
PWM Generator	Selectable timebase
One-Shot Pulse Generator	100µs min, programmable pre- and post-delay
Alarms	High / High-High / Low / Low-Low
Scan Rate	2000 Ch/s
Switching Characteristics	
MAQ20-DIOL	
Input Channel Turn-On/ Turn-Off Time	10µs / 50µs
Output Channel Turn-On/ Turn-Off Time	20µs / 40µs
MAQ20-DIOH	
Input Channel Turn-On/ Turn-Off Time (VAC)	20ms / 30ms
Input Channel Turn-On/ Turn-Off Time (VDC)	1ms / 1ms
Output Channel Response Time	0.5 cycle
Power Supply Current	50mA

The **System Backbone** resides within the DIN rail used for module mounting and provides power to and interface between the communication 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 communication 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.

Once a system is established with a system backbone and a communication 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 communication 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 ReDAQ® Shape host software for MAQ®20 for use in data acquisition and control. Similarly, when a module is removed from any backbone position, the communication module recognizes that it has been unplugged, removes it from the system configuration, and disables it in the ReDAQ® Shape software.

Specifications: Backbone

Model Number	
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 & Remote Location	Male/Female pluggable terminal blocks at each end of backbone allow system expansion and distributed installation

MAQ®20 Future Development

Controller Modules
- Standalone
- Wireless

I/O Modules
- 16 and 24 Bit Analog Input
- Accelerometer Input
- Ch-to-Ch Isolated Inputs
- DC and AC LVDT
- High Sample Rate / High Bandwidth Inputs
- Serial Interface, RS-232 and RS-485
- Single and Three Phase Monitoring
- True RMS Input
- Two-Wire Transmitter Input

Dataforth ReDAQ® Shape Software: Data Acquisition & Control

User Friendly, Fast Learning Curve, Create Custom HMIs

Dataforth offers ReDAQ® Shape software for MAQ®20 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 MAQ®20 functions.

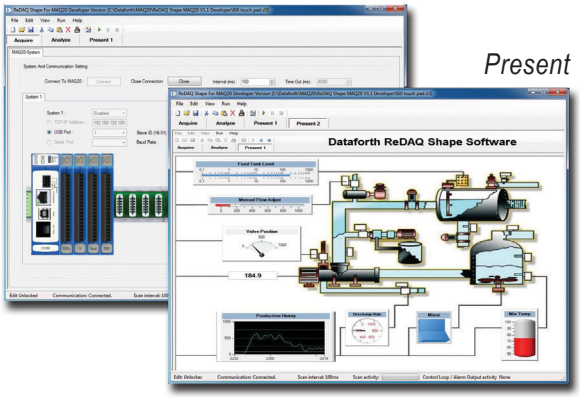
ReDAQ® Shape for MAQ®20 enables users to interact with the Dataforth PID loop controller. In addition, the software provides an effective way to configure and customize MAQ®20 functions for specific application requirements. The toolbox tools are easily moved, re-sized, cut, copied, pasted, and deleted.

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. In addition, 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 MAQ®20 has a very short user-learning curve and offers integrated, across-the-board applicability for data acquisition and control applications.

Acquire

Present



IPEmotion Software: The Next Step for Test & Measurement

Advanced Features, Multi-Language, Multi-Vendor

IPEmotion is a very advanced, intuitive, high performance data acquisition / test and measurement software designed specifically for industrial and R&D applications. Now available for the MAQ®20, this powerful new generation software provides synchronized data acquisition and is easily adaptable to all customer specific requirements.

These requirements may 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.

MAQ®20 / 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.

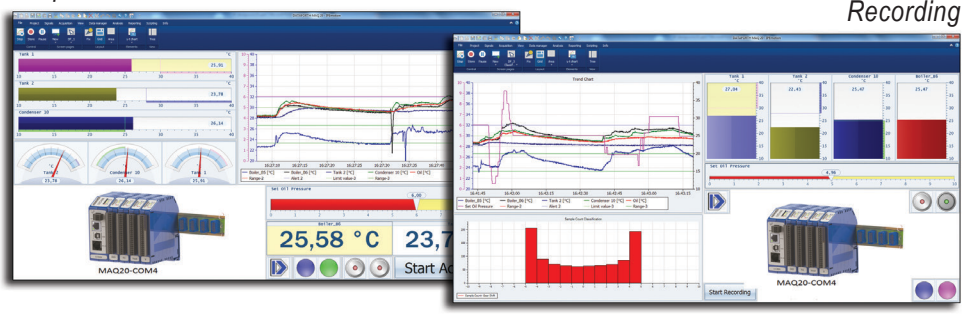
IPEmotion communicates with the MAQ®20 via a PlugIn driver. The software also enables many functions to be integrated by linking external .dll and Visual Basic Script (.VBS) files to the application. This is a powerful tool, as Script enables users to automate the measurement process and to change menus, settings, analyzing procedures, and other aspects of the software.

Key MAQ®20 / IPEmotion Features

- **Live Data Display, Recording, Online & Offline Math and Logic Functions**
- **One-Click Acquisition**
  - **Direct hardware detection, data display & recording**
- **Live Adjustment**
  - **Analyze and verify measurements during active data acquisition**
  - **GUI adaptation during active measurement & storage**
- **Data Analysis**
- **Post Processing & Report Generation**
- **Easy Drag & Drop**
- **High Speed Recording**
- **PlugIn Synchronization**
- **Import and Export Recorded Data to Standard File Formats**
- **Scripting Option**
- **Multilingual**

Acquisition

Recording



Specifications: Accessories

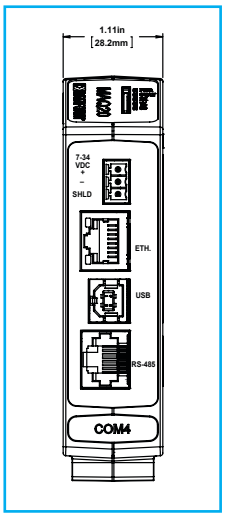
Model Number	
MAQ20-XCA01	Backbone expansion cable, 1m
MAQ20-XCA02	Backbone expansion cable, 2m
SLX147-01/02/05	USB cable, Type A to Type B, 1m, 2m, 5m
SLX141-01/02/07	Ethernet cable, 1m, 2m, 7m
SLX141-X01/X02/X07	Ethernet crossover cable, 1m, 2m, 7m
PWR-PS5RB	Power supply, 24VDC, 0.6A, 100-240VAC input, DIN mount
PWR-PS5RC	Power supply, 24VDC, 1.3A, 100-240VAC input, DIN mount
PWR-PS5RD	Power supply, 24VDC, 2.1A, 100-240VAC input, DIN mount
PWR-PS5RE	Power supply, 24VDC, 4.2A, 100-240VAC input, DIN mount
SCMXRAIL1-XX	DIN EN50022-35x7.5 (slotted steel), length -xx, in meters

Specifications: Boost Power Supply Module

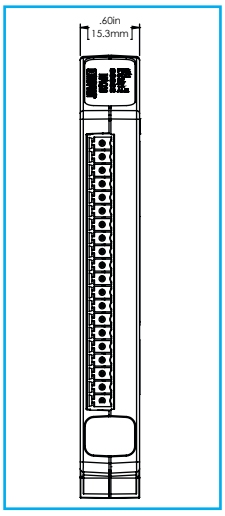
Typical at T_A = +25°C and +24VDC system power

Model Number MAQ20-PWR3	
Power Input	7-34VDC at 2A max 3-position pluggable terminal block
Power Output to Bus	+5VDC at 3A

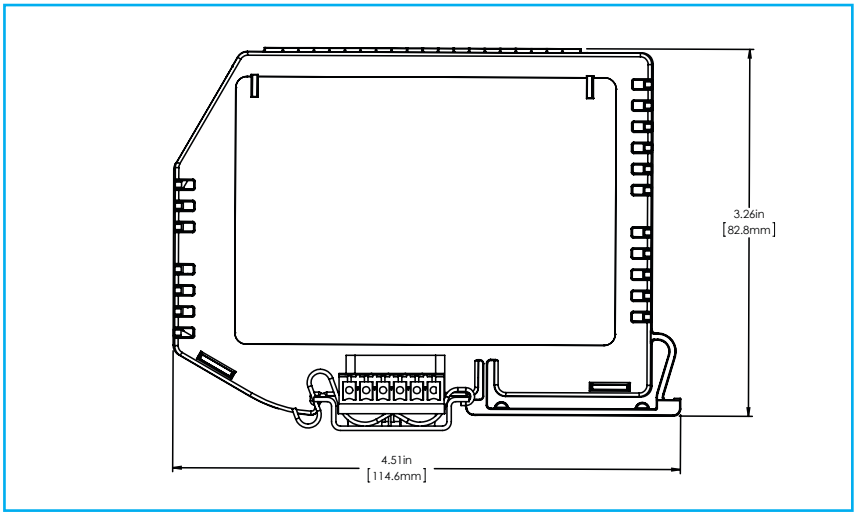
Dimensional Drawings



Front Com Module



Front I/O Module



Side Both Modules

DATAFORTH®

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

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