



MAQ[®]20

Industrial Data Acquisition and Control System

MA1039

MAQ20 LabVIEW VI User Manual

Slot # 2	Model # MAQ20-VDN	# of Registers to Read 8	Local Start Address 1000 Ch 0 - Ch 7 Input Data	Range Selection Ch 0: 4, Ch 1: 4, Ch 2: 4, Ch 3: 4, Ch 4: 2, Ch 5: 1, Ch 6: 3, Ch 7: 2	Input Voltage 3.386, 3.383, 0.01743, 0.01494, 0.01494, 15.44, 2.55, -0.06972
Slot # 3	Model # MAQ20-VO	Local Start Address 1000 Ch 0 - Ch 7 Output Data	Output Voltage Ch 0: -3.5, Ch 1: -10, Ch 2: 2, Ch 3: -3.5, Ch 4: 6.5, Ch 5: 4.3, Ch 6: 5, Ch 7: 6		
Slot # 4	Model # MAQ20-DIOL	# of Registers to Read 5	Local Start Address 1000 Ch D00-D05 Output Data Local Start Address 1000 Ch DI0-DI5 Input Data	Discrete Output DO0: 1, DO1: 1, DO2: 0, DO3: 0, DO4: 1	Discrete Input 0, 1, 0, 1, 0

MAQ20 LabVIEW VI User Manual
MA1039 Rev. C – December 2022
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Table of Contents

1.0 System Features 1

2.0 System Description and Documentation..... 2

3.0 General Description and Software Requirements 2

4.0 System Communications 3

 4.1 Modbus TCP 4

5.0 MAQ20 System and Addressing Overview..... 5

6.0 MAQ20 VIs and LabVIEW Tools Used for Development 8

7.0 MAQ20 Communications Module Interface 18

8.0 MAQ20 Thermocouple Input Module Interface 18

9.0 MAQ20 Millivolt, Voltage & Current Input Module Interface 19

10.0 MAQ20 Voltage & Current Output Module Interface 20

11.0 MAQ20 Discrete Input & Output Module Interface 21

12.0 Reading and Writing Data with the MAQ20 LabVIEW VI 22

13.0 Modifying the Example VI for Use with Other Modules 25

 13.1 Adding a New Module to the Example VI 25

 13.2 Removing an Existing Module from the Example VI 28

14.0 References..... 30

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Errata Sheets

Refer to the Technical Support area of Dataforth’s website (www.dataforth.com) for any errata information on this product.

1.0 System Features

The MAQ20 Data Acquisition System encompasses more than 25 years of design excellence in the process control industry. It is a family of high performance, DIN rail mounted, programmable, multi-channel, industrially rugged signal conditioning I/O and communications modules.

Instrument Class Performance

- $\pm 0.035\%$ Accuracy
- Industry leading $\pm 0.3\text{C}$ CJC Accuracy
- Ultra-low Zero and Span Tempco
- Over-range on one channel does not affect other channels
- 1500Vrms Channel-to-Bus Isolation
- 240Vrms Continuous Field I/O Protection
- ANSI/IEEE C37.90.1 Transient Protection
- Ventilated Communications and I/O Modules
- Industrial Operating Temperature of -40°C to $+85^{\circ}\text{C}$
- Wide Range 7-34VDC Power
- CE Compliant, UL/CUL Listing and ATEX Compliance pending

Industry Leading Functionality

- The system is a Modbus Server and can be operated remotely with no local PC
- Up to 8GB of logged data can be transferred via FTP during real-time acquisition
- Up to 24 I/O modules, or 384 channels, per system, per 19" rack width
- Per-channel configurable for range, alarms, and other functions
- Backbone mounts within DIN rail and distributes power and communications
- System firmware automatically registers the installation and removal of I/O modules
- I/O modules can be mounted remotely from the Communications Module
- Equal load sharing power supply modules allow for system expansion
- Hot Swappable I/O modules with Field-side pluggable terminal blocks on most models
- Sophisticated package enables high density mounting in 3U increments
- DIN Rail can be mounted on a continuous flat panel or plate

Distributed Processing Enables Even More Functionality

- Output modules are programmable for user-defined waveforms
- Discrete I/O modules have seven high level functions:
 - Pulse Counter
 - Frequency Counter
 - Waveform Measurement
 - Time Between Events
 - Frequency Generator
 - PWM Generator
 - One-Shot Pulse Generator

Multiple Software Options

- Free Configuration Software
- Intuitive Graphical Control Software
 - ReDAQ Shape Graphical HMI Design & Runtime Solution
 - Python API
 - LabVIEW VIs
 - OPC Server

2.0 System Description and Documentation

A MAQ20 Data Acquisition System must have as a minimum a Communications Module, a Backbone, and one I/O Module.

Refer to www.dataforth.com/maq20.aspx for a complete listing of available modules and accessories.

System power is connected to the Communications Module, which in turn powers the I/O modules. For systems with power supply requirements exceeding what the Communications Module can provide, the MAQ20-PWR3 Power Supply module is used to 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 for 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.

MAQ20 modules are designed for installation in Class I, Division 2 hazardous locations and have a high level of immunity to environmental noise commonly present in heavy industrial environments.

MAQ20 communications modules provide connection between a host computer and a MAQ20 Data Acquisition System over Ethernet, USB, RS-485, or RS-232. Ethernet communications use the Modbus TCP protocol, USB communications are based on the Modbus RTU protocol, and RS-485 and RS-232 communications use the Modbus RTU protocol. Serial communications over RS-485 can be either 2-wire or 4-wire. Each MAQ20-COMx module can interface to up to 24 MAQ20 I/O modules in any combination allowing high channel counts and great flexibility in system configuration. A removable microSD card can be used by the MAQ20-COMx module to log data acquired from the MAQ20 I/O modules.

For details on hardware installation, configuration, and system operation, refer to the manuals and software available for download from www.dataforth.com/maq20_download.aspx. This includes, but is not limited to:

- [MA1036](#) MAQ20 Quick Start Guide
- [MA1040](#) MAQ20 Communications Module Hardware User Manual
- [MA1041](#) MAQ20 milliVolt, Volt and Current Input Module Hardware User Manual
- [MA1042](#) MAQ20 Voltage and Current Output Module Hardware User Manual
- [MA1043](#) MAQ20-DIOL Discrete IO Module Hardware User Manual
- [MA1047](#) MAQ20 TC Input Module Hardware User Manual
- [MA1038](#) MAQ20 ReDAQ Shape for MAQ20 User Manual
- [MAQ20-940/-941](#) ReDAQ Shape Software for MAQ20 – Developer Version/User Version

3.0 General Description and Software Requirements

The MAQ20 LabVIEW VIs provide a common interface to the MAQ20 Data Acquisition System usable by any SCADA, HMI or other application developed using LabVIEW. This simplifies communication with the MAQ20 and allows quick development of application specific, sophisticated data acquisition, and control systems.

The MAQ20 VIs were created using LabVIEW 2020 SP1 (32-bit) and require LabVIEW's Datalogging and Supervisory Control Module to run. The VIs are not compatible with versions of LabVIEW older than 2020.

Please contact [Dataforth Technical Support](#) if compatibility with a previous version of LabVIEW is required.

The following VIs are available for download from the Software Download Center at www.dataforth.com/maq20_download.aspx:

MAQ20 IO Module TCP Example.vi
 MAQ20-COMX.vi
 MAQ20-MVDN.vi
 MAQ20-VSN.vi
 MAQ20-VDN.vi
 MAQ20-ISN.vi
 MAQ20-IDN.vi
 MAQ20-ISOMV1.vi
 MAQ20-ISOV1.vi
 MAQ20-ISOV2.vi
 MAQ20-ISOV3.vi
 MAQ20-ISOV4.vi
 MAQ20-ISOV5.vi
 MAQ20-ISO11.vi
 MAQ20-JTC.vi
 MAQ20-KTC.vi
 MAQ20-TTC.vi
 MAQ20-RSTC.vi
 MAQ20-RTD31.vi
 MAQ20-RTD41.vi
 MAQ20-BRDG1.vi
 MAQ20-FREQ.vi
 MAQ20-VO.vi
 MAQ20-IO.vi
 MAQ20-DIOL.vi
 MAQ20-DIOH.vi
 MAQ20-DIVX20.vi
 MAQ20-DODC20SK.vi
 MAQ20-DORLY20.vi

4.0 System Communications

The MAQ20 uses Modbus TCP protocol for communication over Ethernet and Modbus RTU protocol for communication over USB, RS-485 and RS-232. Refer to *MA1040 MAQ20 Communications Module Hardware User Manual* found at www.dataforth.com/maq20_download.aspx for detailed information on communications setup. VIs are set up for communication over Ethernet.

The Modbus TCP Master and Close VIs provide the basic communications interface.



Figure 1: Modbus TCP VIs

A single Modbus TCP Master VI is used for communication to all MAQ20 VIs that are present in a system.

4.1 Modbus TCP

The standard method of Ethernet connection to the MAQ20 is to use a static IP address. The factory default is:

MAQ20 factory default static IP address: 192.168.128.100

If desired, the IP address can be changed using ReDAQ Shape Software for MAQ20.

Configure the Ethernet port on the host computer to also use a static IP address. In Windows 7 and Windows 10, this is done by choosing Control Panel > Network and Internet > Network and Sharing Center. Next select Change Adapter Settings, select the network adapter to be used for the Channel and select Properties, then select TCP/IPv4 and Properties.

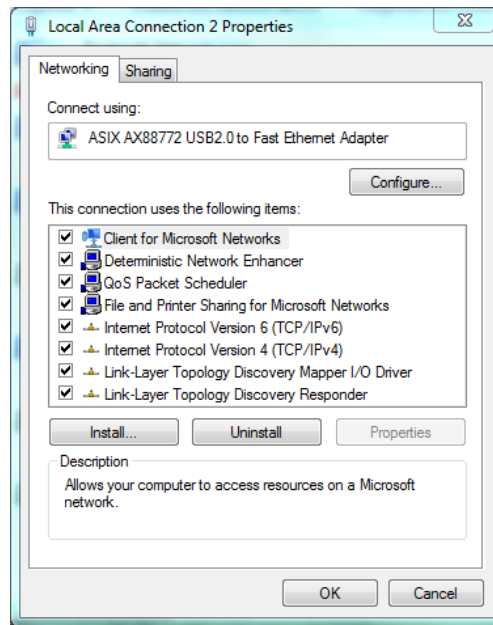


Figure 2: Host Computer Ethernet Port Configuration

Configure the port to use a static IP address.

Host computer static IP Address: 192.168.xxx.xxx

Choose any address that does not match the one set in the MAQ20. If the MAQ20 is set for 192.168.128.100, set the host computer to a lower address such as 192.168.128.095 for faster response.

Host computer Subnet Mask: 255.255.255.0

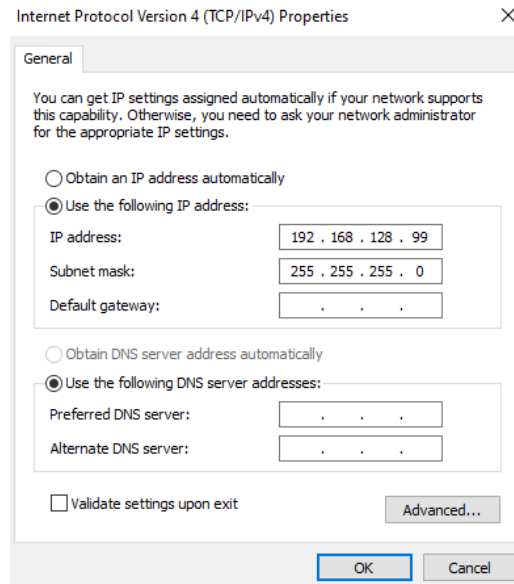


Figure 3: Host Computer IP Address & Subnet Mask

5.0 MAQ20 System and Addressing Overview

The MAQ20 Data Acquisition System uses an automated registration process which periodically scans the system and will detect when MAQ20 I/O modules are added and removed. Each module is assigned an address space of 2000 addresses based on the Registration Number and starting at address 2000. I/O module with Registration Number 1 is assigned address space 2000 – 3999, I/O module with Registration Number 2 is assigned address space 4000 – 5999 and so on. The starting address for the module is very important because this is the offset address that must be added to the addresses listed in the I/O module address map to know where data for that module is located within the system level address map. The MAQ20-COMx Communication Module is always assigned a Registration Number of 0. Channel data for the MAQ20 Input and Output modules is stored starting at address 1000 within each module register space.

Address Maps for each module are found at the end of the individual MAQ20 I/O and Communication module hardware user manuals. A few of these are listed below.

- [MA1040](#) MAQ20 Communications Module Hardware User Manual
- [MA1041](#) MAQ20 milliVolt, Volt and Current Input Module Hardware User Manual
- [MA1042](#) MAQ20 Voltage & Current Output Module Hardware User Manual
- [MA1043](#) MAQ20-DIOL Discrete IO Module Hardware User Manual
- [MA1044](#) MAQ20 RTD-Potentiometer Input Module Hardware User Manual
- [MA1046](#) MAQ20 Strain Gage Input Module Hardware User Manual
- [MA1047](#) MAQ20 TC Input Module Hardware User Manual
- [MA1048](#) MAQ20 Frequency Input Module Hardware User Manual

The VI titled *MAQ20 IO Module Interface TCP Example* shows how to interface the provided VIs to create a MAQ20 system comprised of:

- | | |
|----------------------------|---|
| MAQ20-COM4 | Communications Module |
| MAQ20-JTC | 8-Channel J-Type Thermocouple Input Module |
| MAQ20-VDN | 8-Channel Differential Voltage Input Module |
| MAQ20-VO | 8 Isolated Channel Voltage Output Module |
| MAQ20-DIOL | 5 Discrete Output / 5 Discrete Input Module |

The system details can be viewed using ReDAQ Shape Software for MAQ20 available from the Dataforth website, www.dataforth.com/maq20_download.aspx.

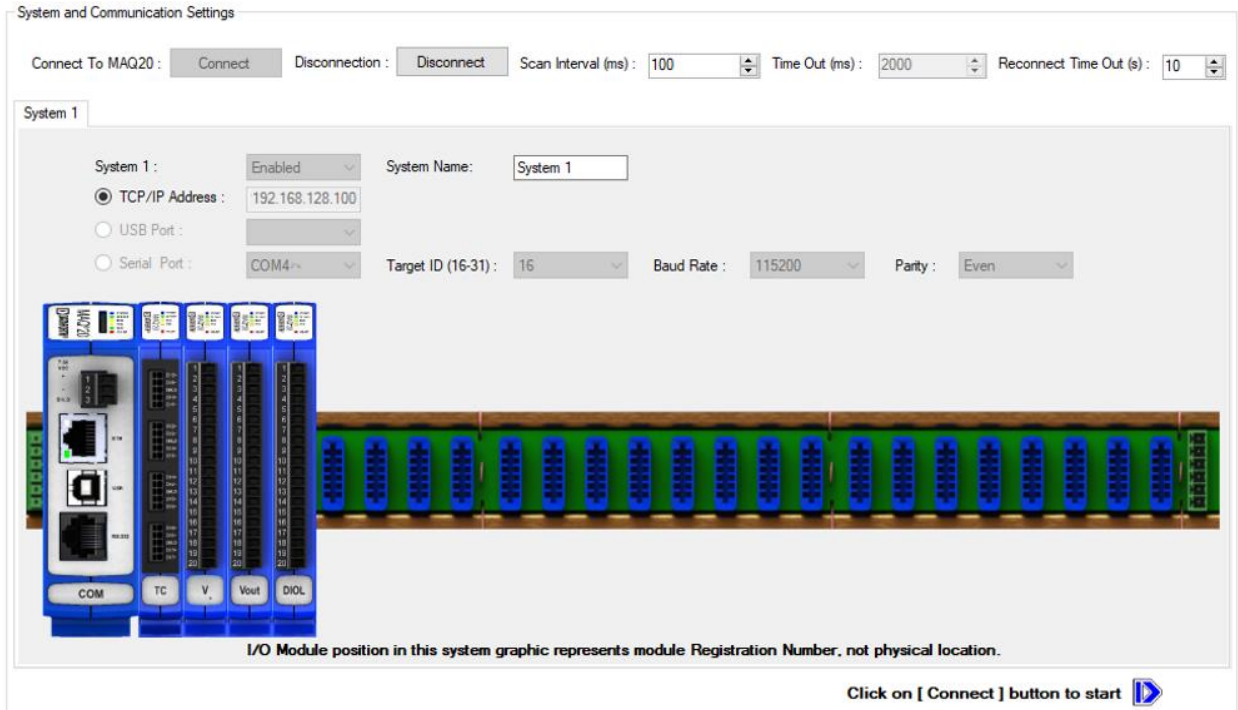


Figure 4: ReDAQ Shape System Display

For optimal VI operation of the MAQ20 IO Module Interface TCP Example VI, arrange the I/O modules in the system as follows using ReDAQ Shape Software for MAQ20.

Slot 0	MAQ20-COM4	Start Address 0000
Slot 1	MAQ20-JTC	Start Address 2000
Slot 2	MAQ20-VDN	Start Address 4000
Slot 3	MAQ20-VO	Start Address 6000
Slot 4	MAQ20-DIOL	Start Address 8000

When using ReDAQ Shape Software for MAQ20, click on the communications module graphic to view system configuration. Highlight a module and use the Up and Down buttons to make the Slot Number match the physical position on the backbone. Click the Save button once module positions are at their desired locations.

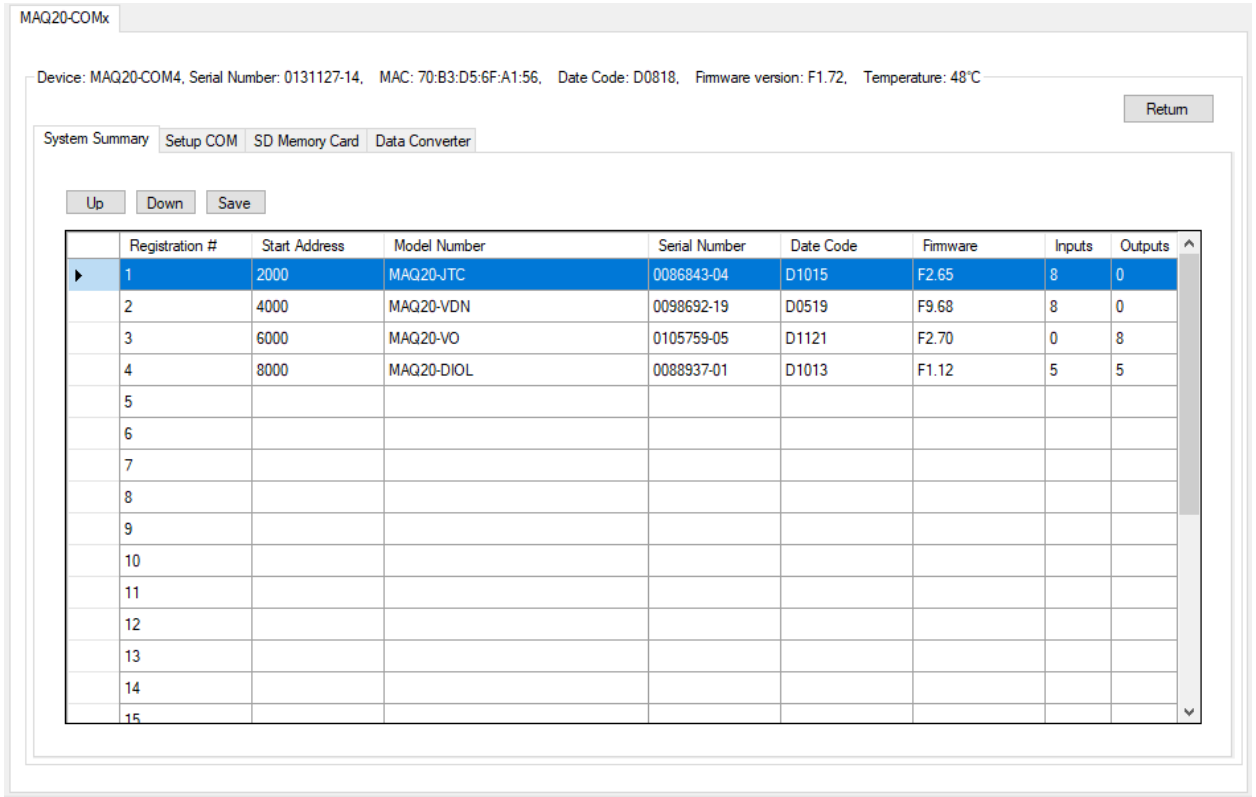


Figure 5: ReDAQ Shape Display of Modules by Slot Number

Modbus Function Codes

The MAQ20 Data Acquisition System supports the following Modbus function codes (commands):

- 3, Read Input Registers
- 4, Read Holding Registers
- 6, Write Single Register
- 16, Write Multiple Registers

Modbus Addresses

The system makes no distinction between Modbus Input registers and Modbus Holding registers. Read Input Registers will return the same data as Read Holding Registers as long as both commands use the same address and quantity.

Modbus addresses are 0-based, meaning the first address is 0x0000 (0) and the last is 0xFFFF (65535). Address values map directly to address fields of all Modbus commands. Although only a small percentage of available Modbus addresses are mapped to data and/or control functions, the system allows access to the entire range of Modbus addresses. If a Read command accesses an address that the system does not map, 0x0000 will be returned. If a Write command accesses an address that the system does not map, the write will have no effect.

Modbus Exceptions


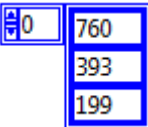



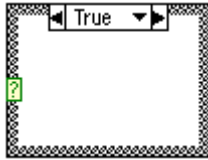

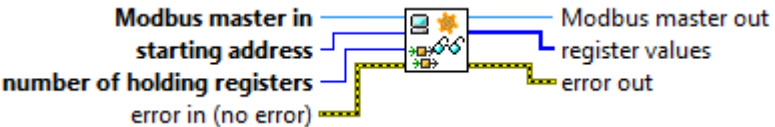
The system will return the following Modbus exception codes under the given conditions:

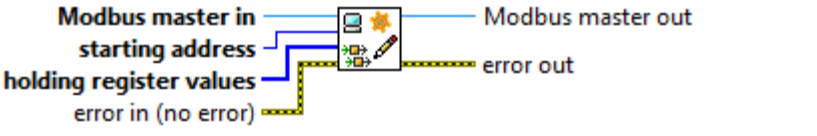
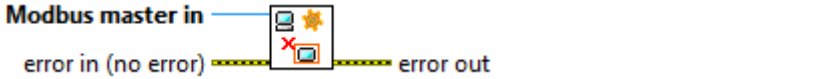
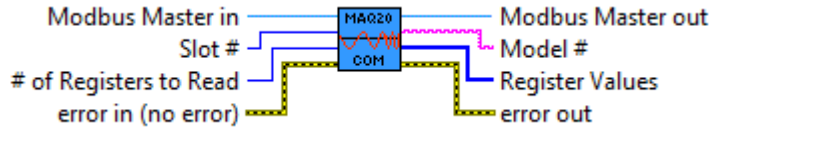
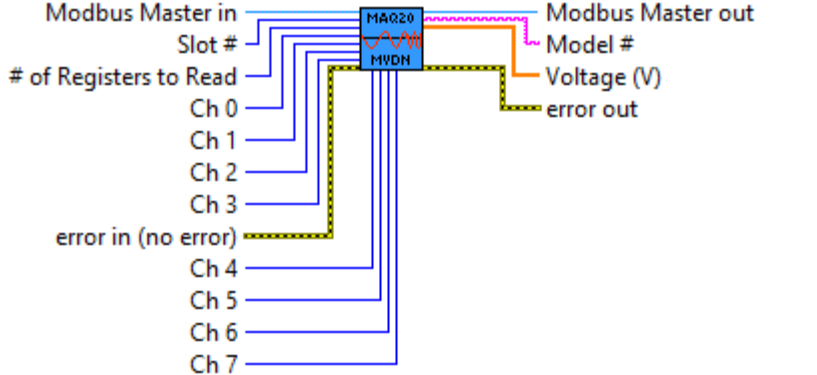
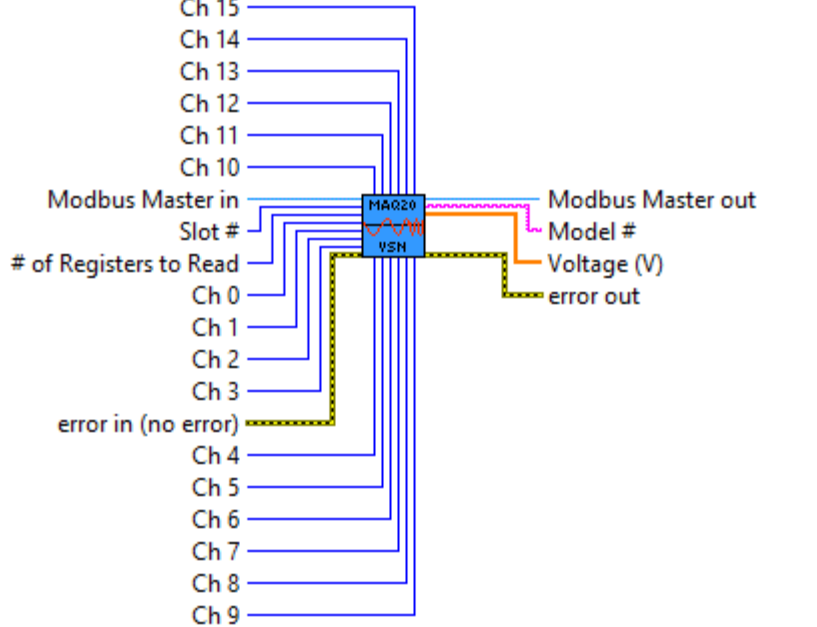
- 1, Illegal Function: The received function code is unknown or not supported.
- 2, Illegal Address: The received address and quantity would access data beyond address 0xFFFF.
- 3, Illegal Data: The number of bytes in the request does not match that expected or one or more fields of the command contains an invalid value (i.e., a quantity field is zero or too large, a byte count field is zero or does not agree with the quantity field, etc.).
- 6, Server Busy: This exception only occurs with Modbus TCP and indicates that the MAQ20 Data Acquisition System is already processing its maximum number of simultaneous transactions and cannot accept more. The request should be re-issued after a response is received from one of the four active transactions.

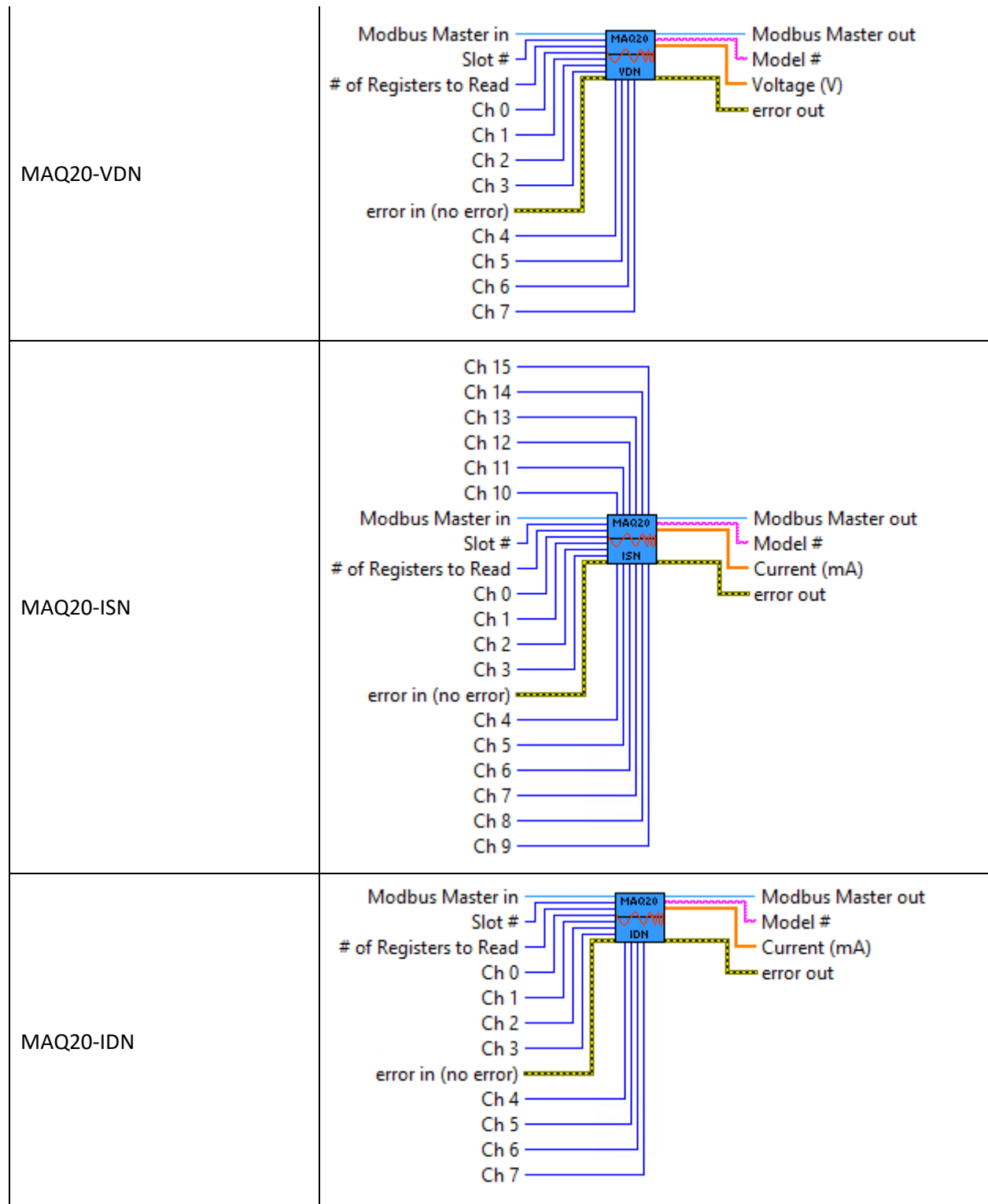
6.0 MAQ20 VIs and LabVIEW Tools Used for Development

Controls	
Unsigned 16-bit	
Signed 32-bit	
Unsigned 32-bit	
Signed 32-bit	
Double 64-bit	
Stop	
Data Containers	
Cluster	
Indicators	
Unsigned 16-bit Array	

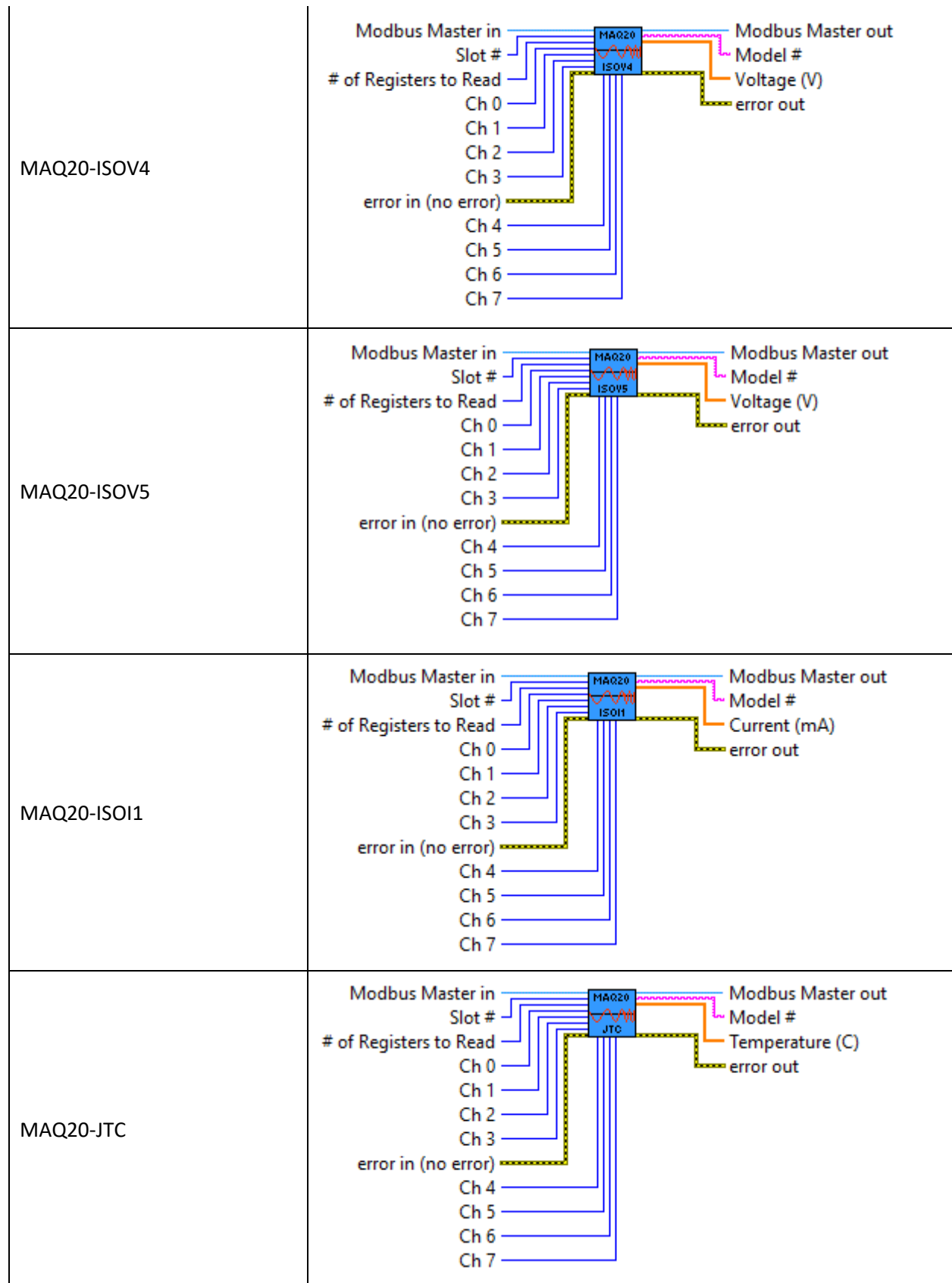
Double 64-bit Array	
String	
Functions	
Wait	
Multiply	
Divide	
Add	
Subtract	
To Unsigned Byte Integer	
Byte Array to String	
To Word Integer	
Functions	
Index Array	
Build Array	

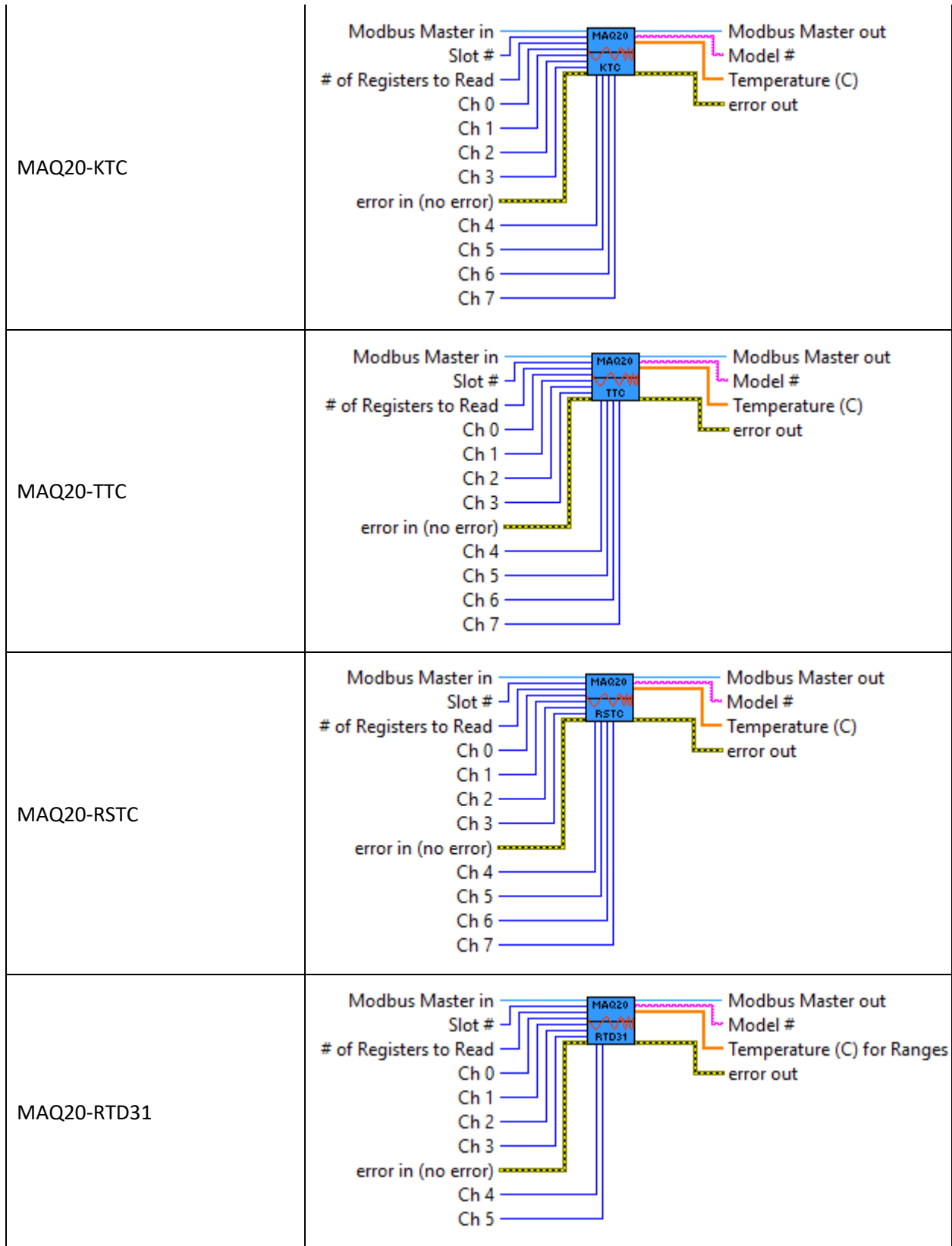
Constants	
Numeric Unsigned 16-bit Integer	
Numeric Array	
Double Precision	
Structures	
While Loop	
For Loop	
Case Structure	
VIs	
New TCP Master	
Read Holding Registers	

<p>Write Multiple Holding Registers</p>	 <p>Modbus master in starting address holding register values error in (no error)</p> <p>Modbus master out error out</p>
<p>Close Modbus Master</p>	 <p>Modbus master in error in (no error)</p> <p>error out</p>
<p>MAQ20-COMX</p>	 <p>Modbus Master in Slot # # of Registers to Read error in (no error)</p> <p>MAQ20 COM</p> <p>Modbus Master out Model # Register Values error out</p>
<p>MAQ20-MVDN</p>	 <p>Modbus Master in Slot # # of Registers to Read Ch 0 Ch 1 Ch 2 Ch 3 Ch 4 Ch 5 Ch 6 Ch 7 error in (no error)</p> <p>MAQ20 MVDN</p> <p>Modbus Master out Model # Voltage (V) error out</p>
<p>MAQ20-VSN</p>	 <p>Ch 15 Ch 14 Ch 13 Ch 12 Ch 11 Ch 10 Modbus Master in Slot # # of Registers to Read Ch 0 Ch 1 Ch 2 Ch 3 Ch 4 Ch 5 Ch 6 Ch 7 Ch 8 Ch 9 error in (no error)</p> <p>MAQ20 VSN</p> <p>Modbus Master out Model # Voltage (V) error out</p>



<p>MAQ20-ISOMV1</p>	<p>Modbus Master in Slot # # of Registers to Read Ch 0 Ch 1 Ch 2 Ch 3 error in (no error) Ch 4 Ch 5 Ch 6 Ch 7</p> <p>MAQ20 ISOMV1</p> <p>Modbus Master out Model # Voltage (V) error out</p>
<p>MAQ20-ISOV1</p>	<p>Modbus Master in Slot # # of Registers to Read Ch 0 Ch 1 Ch 2 Ch 3 error in (no error) Ch 4 Ch 5 Ch 6 Ch 7</p> <p>MAQ20 ISOV1</p> <p>Modbus Master out Model # Voltage (V) error out</p>
<p>MAQ20-ISOV2</p>	<p>Modbus Master in Slot # # of Registers to Read Ch 0 Ch 1 Ch 2 Ch 3 error in (no error) Ch 4 Ch 5 Ch 6 Ch 7</p> <p>MAQ20 ISOV2</p> <p>Modbus Master out Model # Voltage (V) error out</p>
<p>MAQ20-ISOV3</p>	<p>Modbus Master in Slot # # of Registers to Read Ch 0 Ch 1 Ch 2 Ch 3 error in (no error) Ch 4 Ch 5 Ch 6 Ch 7</p> <p>MAQ20 ISOV3</p> <p>Modbus Master out Model # Voltage (V) error out</p>





<p>MAQ20-RTD41</p>	<p>Modbus Master in Slot # # of Registers to Read Ch 0 Ch 1 Ch 2 Ch 3 error in (no error) Ch 4</p> <p>MAQ20 RTD41</p> <p>Modbus Master out Model # Temperature (C) error out</p>
<p>MAQ20-BRDG1</p>	<p>Modbus Master in Slot # EXC (V) Ch 0 Ch 1 Ch 2 Ch 3 error in (no error)</p> <p>MAQ20 BRDG1</p> <p>Modbus Master out Model # Voltage (V) EXC (V) error out</p>
<p>MAQ20-FREQ</p>	<p>Modbus Master in Slot # EXC (V) Ch 0 Ch 1 Ch 2 Ch 3 error in (no error) Ch 4 Ch 5 Ch 6 Ch 7</p> <p>MAQ20 FREQ</p> <p>Modbus Master out Model # Frequency (Hz) error out</p>
<p>MAQ20-VO</p>	<p>Modbus Master in Slot # Ch 0 Ch 1 Ch 2 Ch 3 Ch 4 error in (no error) Ch 5 Ch 6 Ch 7</p> <p>MAQ20 VO</p> <p>Modbus Master out Model # error out</p>

<p>MAQ20-IO</p>	<p>Modbus Master in Slot # Ch 0 Ch 1 Ch 2 Ch 3 Ch 4 Ch 5 Ch 6 Ch 7 error in (no error)</p> <p>MAQ20 IO</p> <p>Modbus Master out Model # error out</p>
<p>MAQ20-DIOL</p>	<p>Modbus Master in Slot # # of Registers to Read DO0 DO1 DO2 DO3 error in (no error) DO4</p> <p>MAQ20 DIOL</p> <p>Modbus Master out Model # Discrete Input error out</p>
<p>MAQ20-DIOH</p>	<p>Modbus Master in Slot # # of Registers to Read DO0 DO1 DO2 DO3 error in (no error)</p> <p>MAQ20 DIOH</p> <p>Modbus Master out Model # Discrete Input error out</p>
<p>MAQ20-DIVX20</p>	<p>Modbus Master in Slot # Logic Polarity error in (no error)</p> <p>MAQ20 DIVX20</p> <p>Modbus Master out Model # Channel State error out</p>
<p>MAQ20-DODC20SK</p>	<p>Modbus Master in Slot # Logic Polarity Channel Control error in (no error)</p> <p>MAQ20 DODC 20SK</p> <p>Modbus Master out Model # Channel State error out</p>
<p>MAQ20-DORLY20</p>	<p>Modbus Master in Slot # Logic Polarity Channel Control error in (no error)</p> <p>MAQ20 DORLY 20</p> <p>Modbus Master out Model # Channel State error out</p>

7.0 MAQ20 Communications Module Interface

Internal to the MAQ20-COMX VI, one Read Holding Registers VI is used to read the module Model #, and a second is used to read the registers containing the data for the Real Time Clock. Slot # is multiplied by 2000 to generate the address offset.

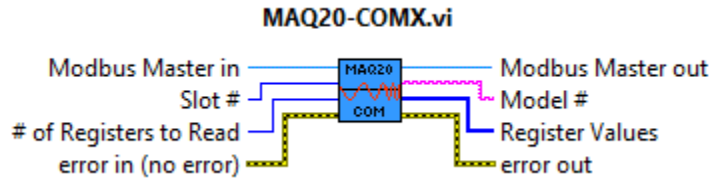


Figure 6: MAQ20-COM2 or -COM4 Basic VI Structure

The MAQ20-COM4 module in the demonstration system has a registration number of 0 and an address offset of $2000 * 0 = 0$. The addresses to read from are 0 (address offset) + 1200 (RTC seconds) = 1200, through 0 (address offset) + 1206 (RTC year) = 1206.

Note: The MAQ20-COMx module will always be located in slot number 0.

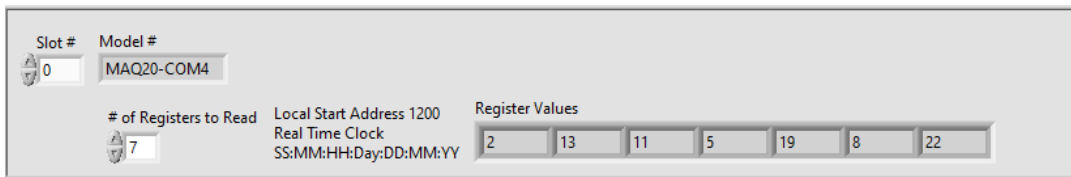


Figure 7: MAQ20-COM2 or -COM4 VI User Interface

8.0 MAQ20 Thermocouple Input Module Interface

Internal to the MAQ20-JTC VI, one Read Holding Registers VI is used to read the module Model #, a second is used to read the registers containing the data from the input channels, and a third is used to set the individual ranges for the channels. Slot # is multiplied by 2000 to generate the address offset.

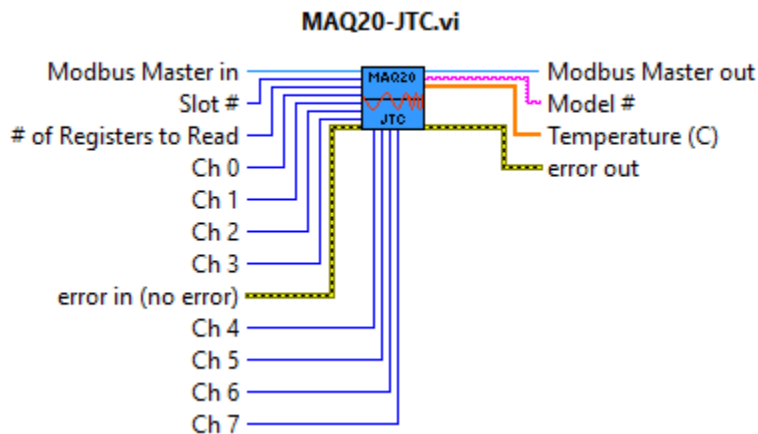


Figure 8: MAQ20-JTC Basic VI Structure

To obtain the optimum range and resolution for given measurements, MAQ20 input module input ranges can be configured on a per-channel basis using the VI.

Table 1: MAQ20-JTC Range Assignment

	Range	Standard Input Temperature	Equivalent Counts	Over/Under Range	Equivalent Counts	Deg C per Count
JTC	0	-100°C to +760°C (Default)	-539 to 4095	-102°C to +775°C	-550 to 4177	0.1855
	1	-100°C to +393°C	-1078 to 4236	-102°C to +401°C	-1100 to 4321	0.0928
	2	-100°C to +199°C	-2156 to 4290	-102°C to +203°C	-2199 to 4376	0.0464

Count mapping for the MAQ20-JTC module has been built into the VI. Range and count mapping are applied to the measured data and then the resulting measured temperature is displayed.

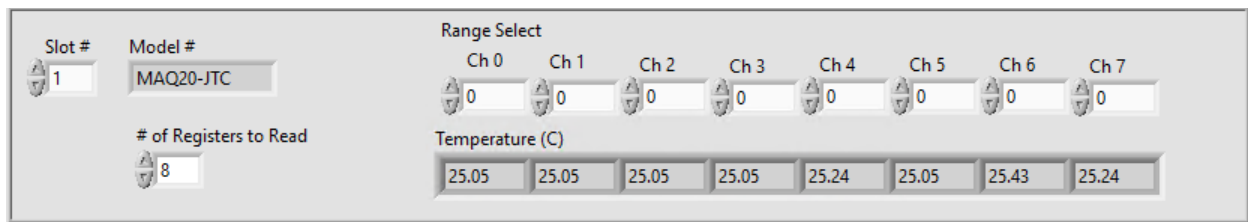


Figure 9: MAQ20-JTC VI User Interface

9.0 MAQ20 Millivolt, Voltage & Current Input Module Interface

Internal to the MAQ20-VDN VI, one Read Holding Registers VI is used to read the module Model #, a second is used to read the registers containing the data from the input channels, and a third is used to set the individual ranges for the input channels. Slot # is multiplied by 2000 to generate the address offset.

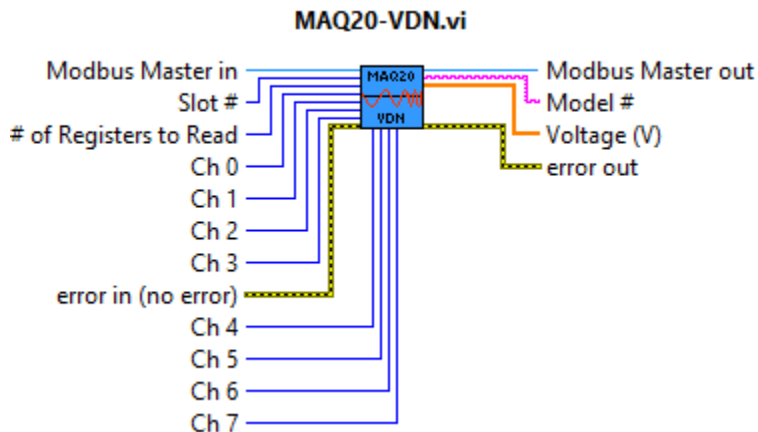


Figure 10: MAQ20-VDN Basic VI Structure

To obtain the optimum range and resolution for given measurements, MAQ20 input module input ranges can be configured on a per-channel basis using the VI.

Table 2: MAQ20-VDN Range Assignment

	Range	Standard Input Voltage	Equivalent Counts	Over/Under Range	Equivalent Counts	Volts per Count
MAQ20-VDN	0	-60V to +60V	-4016 to 4016	-61.2V to +61.2V	-4096 to 4095	0.01494
	1	-40V to +40V	-4016 to 4016	-40.8V to +40.8V	-4096 to 4095	0.009961
	2	-20V to +20V	-4016 to 4016	-20.4V to +20.4V	-4096 to 4095	0.004980
	3	-10V to +10V	-4016 to 4016	-10.2V to +10.2V	-4096 to 4095	0.002490
	4	-5V to +5V (Default)	-4016 to 4016	-5.1V to +5.1V	-4096 to 4095	0.001245

Count mapping for the MAQ20-VDN module has been built into the VI. Range and count mapping are applied to the measured data and then the resulting measured voltage is displayed.

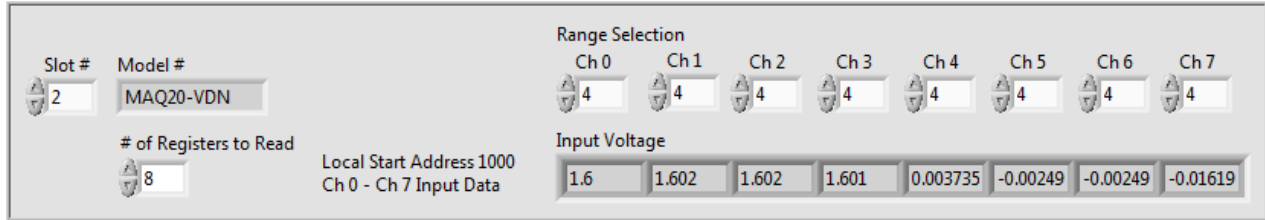


Figure 11: MAQ20-VDN VI User Interface

10.0 MAQ20 Voltage & Current Output Module Interface

Internal to the MAQ20-VO VI, one Read Holding Registers VI is used to read the module Model #, Slot # is multiplied by 2000 to generate the address offset.

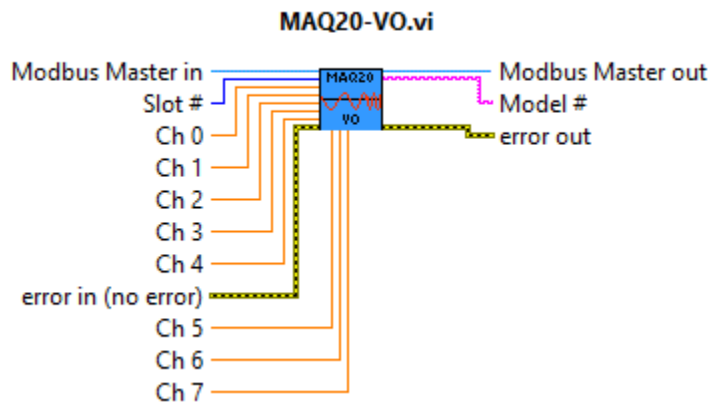


Figure 12: MAQ20-VO Basic VI Structure

The MAQ20-VO VI is hardcoded with a range setting of 0. This range was selected as the default range since its output voltage span covers the spans of all other ranges. The VI does not allow for the user to change the range during program execution. If a different range is required it can be set by changing the labeled constant within the VI's Block Diagram:

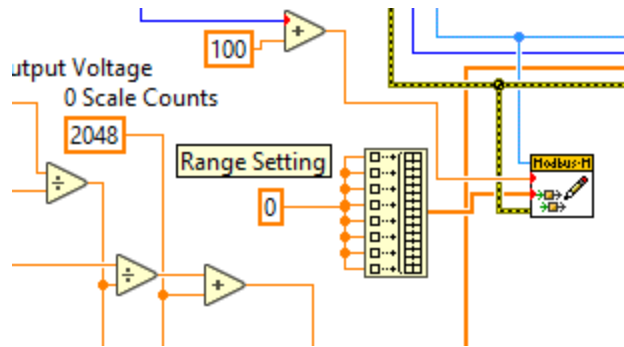


Figure 13: MAQ20-VO VI Block Diagram for Range Implementation

Table 3: MAQ20-VO Range Assignment

Range	Standard Output Voltage	Equivalent Counts	Over/Under Range	Equivalent Counts	Volts per Count
0	-10V to +10V (Default)	98 to 3998	-10.5V to +10.5V	0 to 4095	0.005128
1	-5V to +5V	1073 to 3023	-5.25V to +5.25V	1024 to 3072	0.005128
2	-2.5V to +2.5V	1561 to 2536	-2.625V to +2.625V	1536 to 2560	0.005128
3	0 to +10V	2048 to 3998	0 to +10.5V	2048 to 4095	0.005128
4	0 to +5V	2048 to 3023	0 to +5.25V	2048 to 3072	0.005128
5	0 to +2.5V	2048 to 2536	0 to +2.625V	2048 to 2560	0.005128

To enter data to be written to the module in engineering units, count mapping for the MAQ20-VO module has been built into the VI. Range and count mapping are applied to the data to be written and then the resulting signal representation in counts is sent to the module.

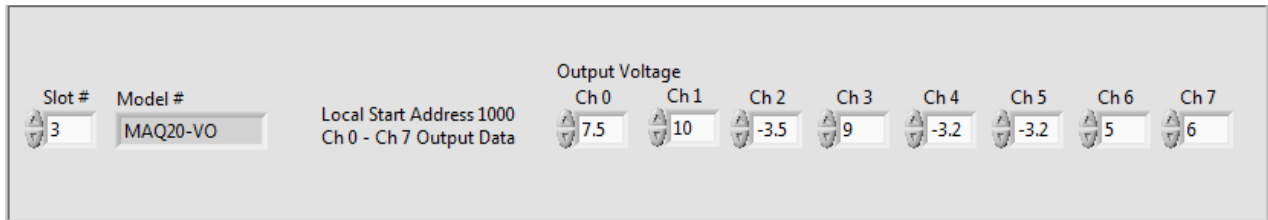


Figure 14: MAQ20-VO VI User Interface

11.0 MAQ20 Discrete Input & Output Module Interface

Internal to the MAQ20-DIOL VI, one Read Holding Registers VI is used to read the module Model # and a second is used to read the registers containing the data from the input channels. A Write Holding Registers VI is used for writing data to the registers controlling the channel discrete output states. Slot # is multiplied by 2000 to generate the address offset.

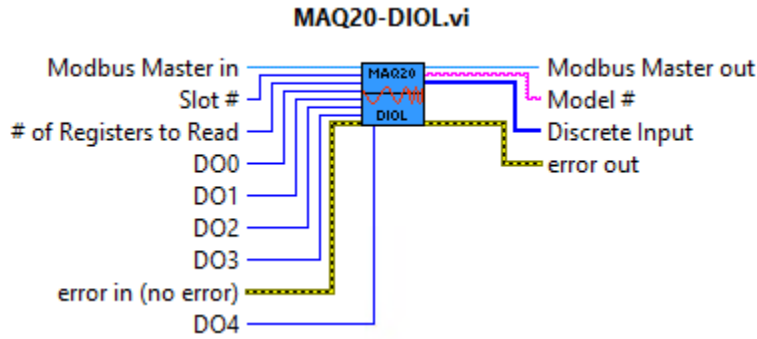


Figure 15: MAQ20-DIOL Basic VI Structure

The MAQ20-DIOL module in the demonstration system has a registration number of 4 and an address offset of $2000 * 4 = 8000$.

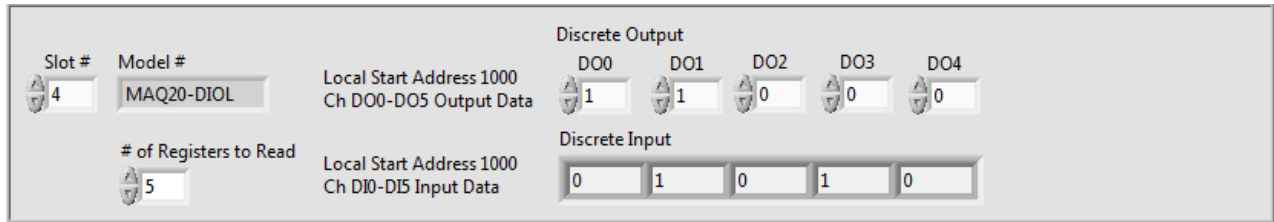


Figure 16: MAQ20-DIOL VI User Interface

12.0 Reading and Writing Data with the MAQ20 LabVIEW VI

The MAQ20 IO Module Interface TCP Example VI allows read/write operations to MAQ20 modules for 5 slots, or a MAQ20 data acquisition system comprised of one Communications Module and 4 I/O Modules.

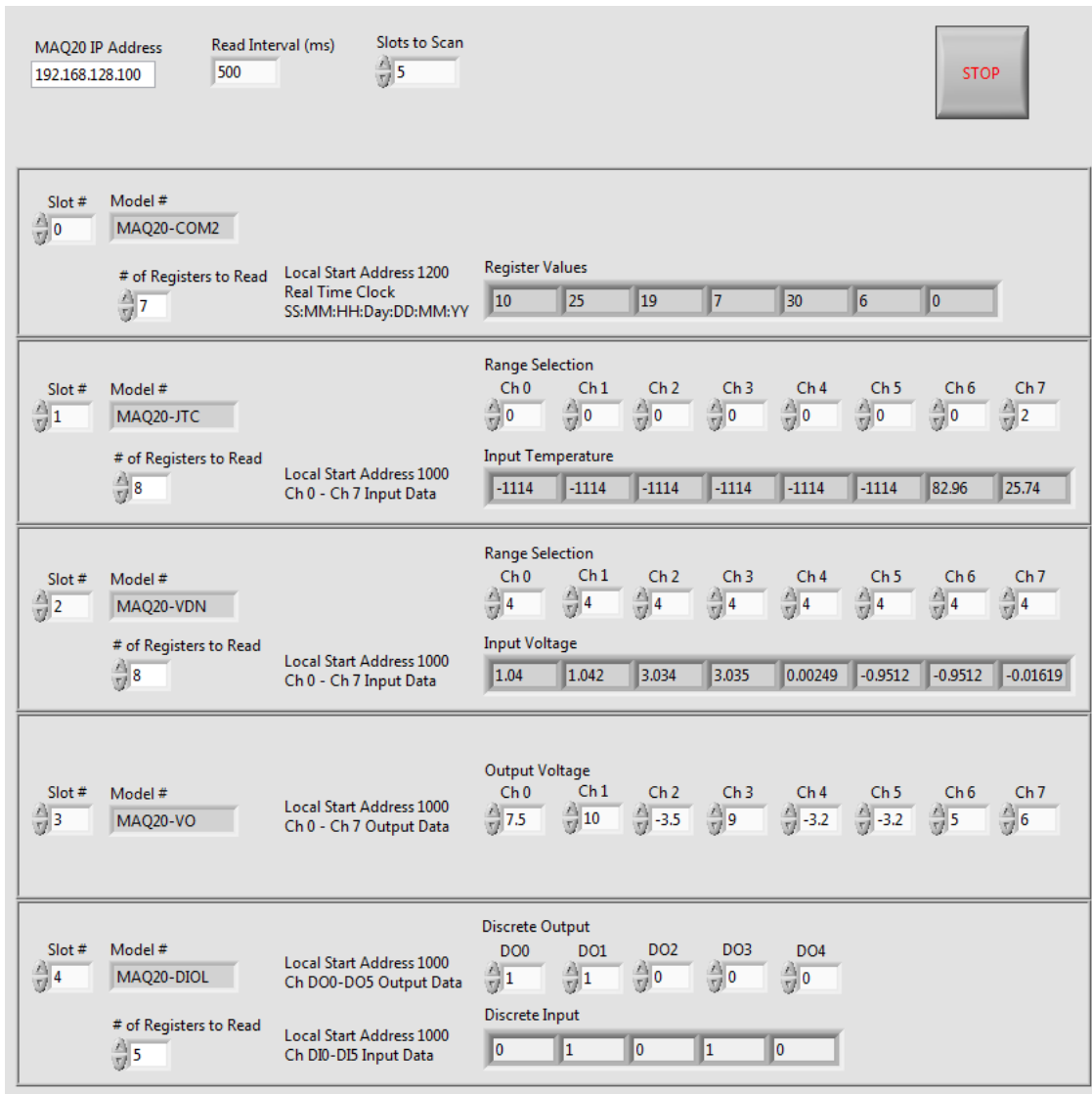


Figure 17: MAQ20 IO Module Interface TCP Example VI User Interface

The number of read interval, number of slots to scan, slot displayed, and the number of registers to read are all selectable by the user. This VI has a user interface optimized for the following system configuration:

- Slot 0 MAQ20-COM4
- Slot 1 MAQ20-JTC
- Slot 2 MAQ20-VDN
- Slot 3 MAQ20-VO
- Slot 4 MAQ20-DIOL

The interface to each type of MAQ20 module has been built into a Case Structure, and this is embedded in a For Loop, so each module is scanned sequentially and continuously.

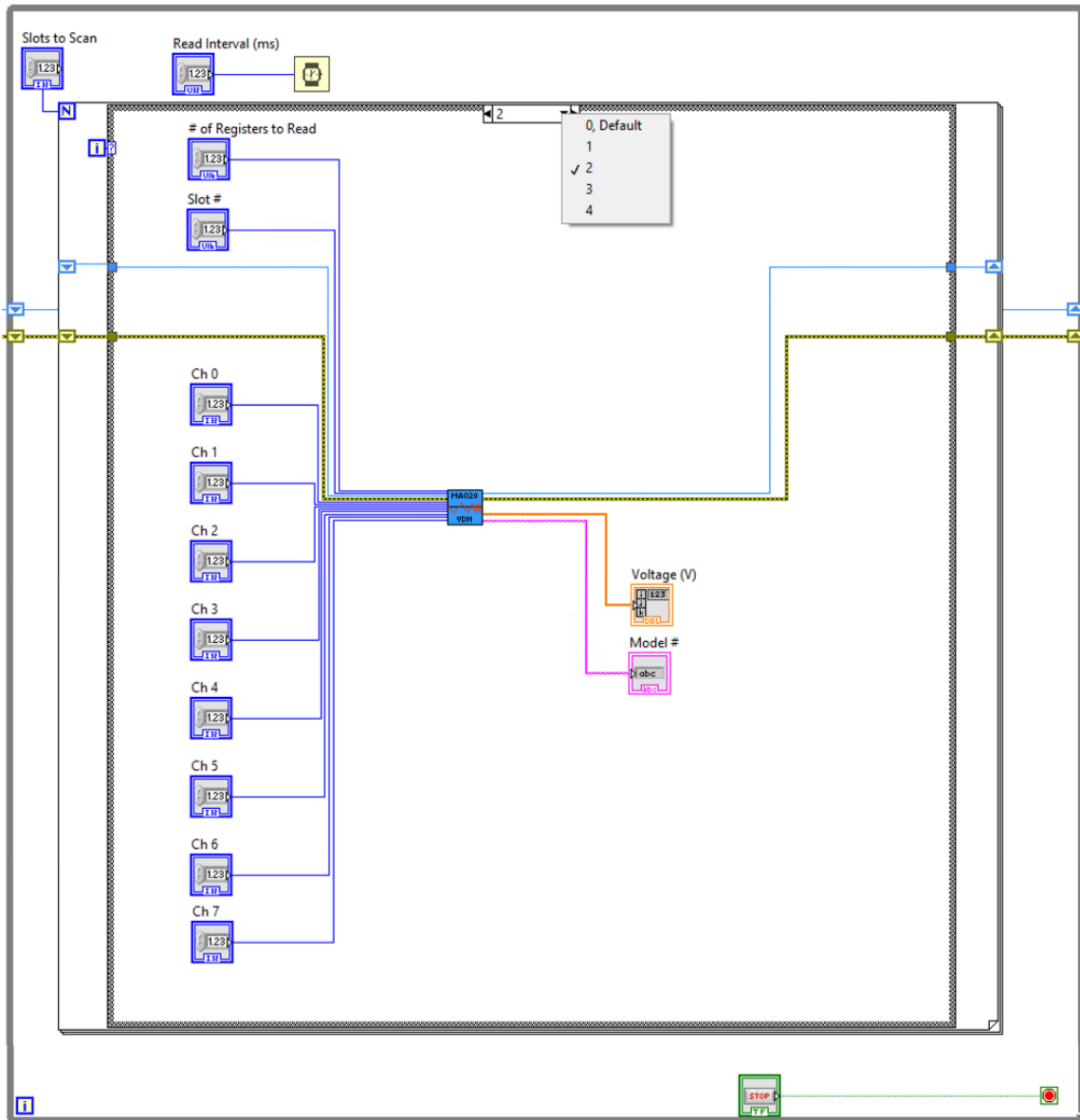


Figure 18: MAQ20 IO Module Interface TCP Example VI

13.0 Modifying the Example VI for Use with Other Modules

The MAQ20 IO Module Interface TCP Example VI can be modified to match any given MAQ20 system configuration. This can be done by adding or removing individual MAQ20 module VIs from the main case structure in the VIs Block Diagram window.

13.1 Adding a New Module to the Example VI

Open the example VI in LabVIEW and navigate to the VI Block Diagram by selecting Window > Show Block Diagram.

Use the case selector icon to select case #4 of the structure. Once on case #4, right clicking on the case selector icon will present the user with an option for adding a case after the current selection.

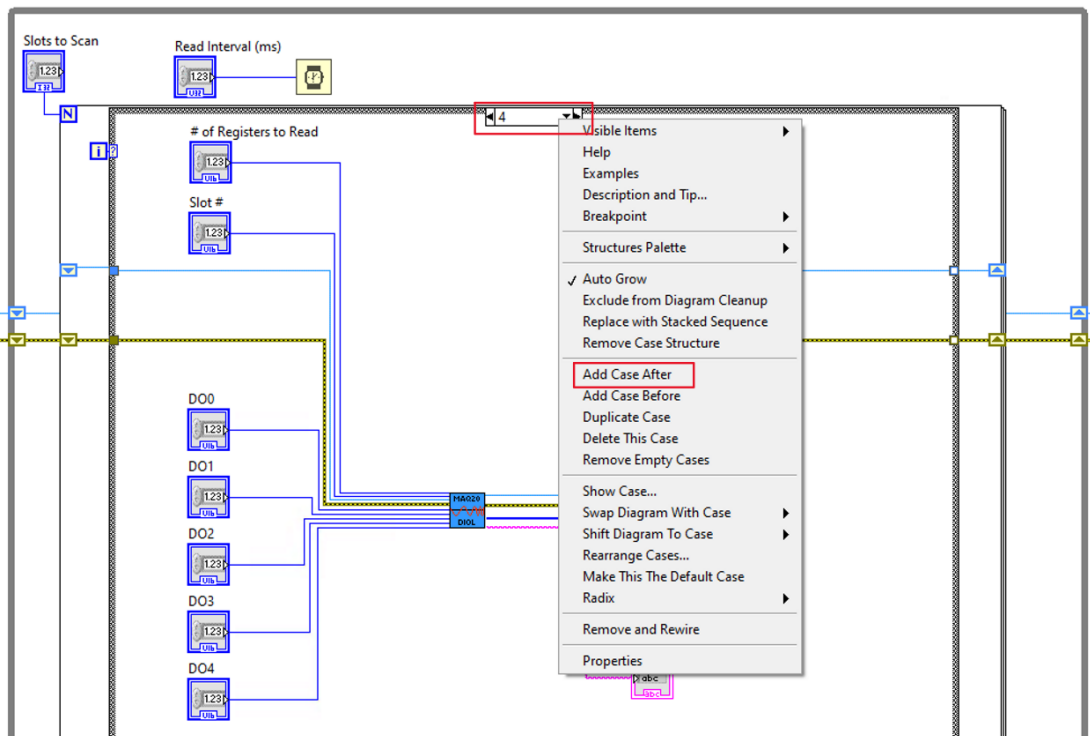


Figure 19: Modifying Cases Structure

After adding a new case to the case structure, the desired VI can be added to the example project by right clicking inside the new case's box outline and selecting the "Select a VI..." option from the dropdown menu.

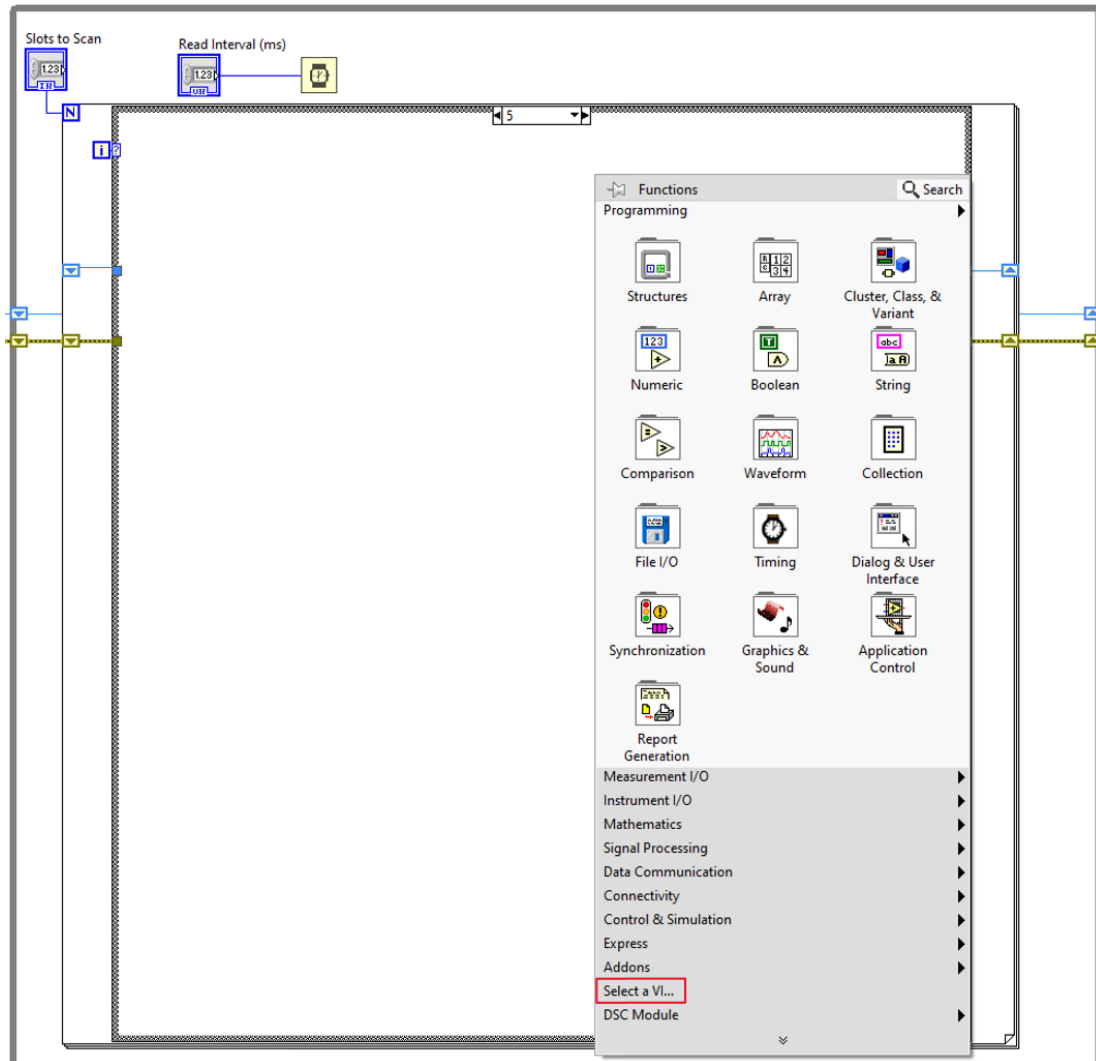


Figure 20: Selecting a VI for the added case.

Once the desired VI has been added to the case structure, inputs and outputs to the VI need to be configured. This can be done automatically by right clicking on the VI->Create->All Controls and Indicators.

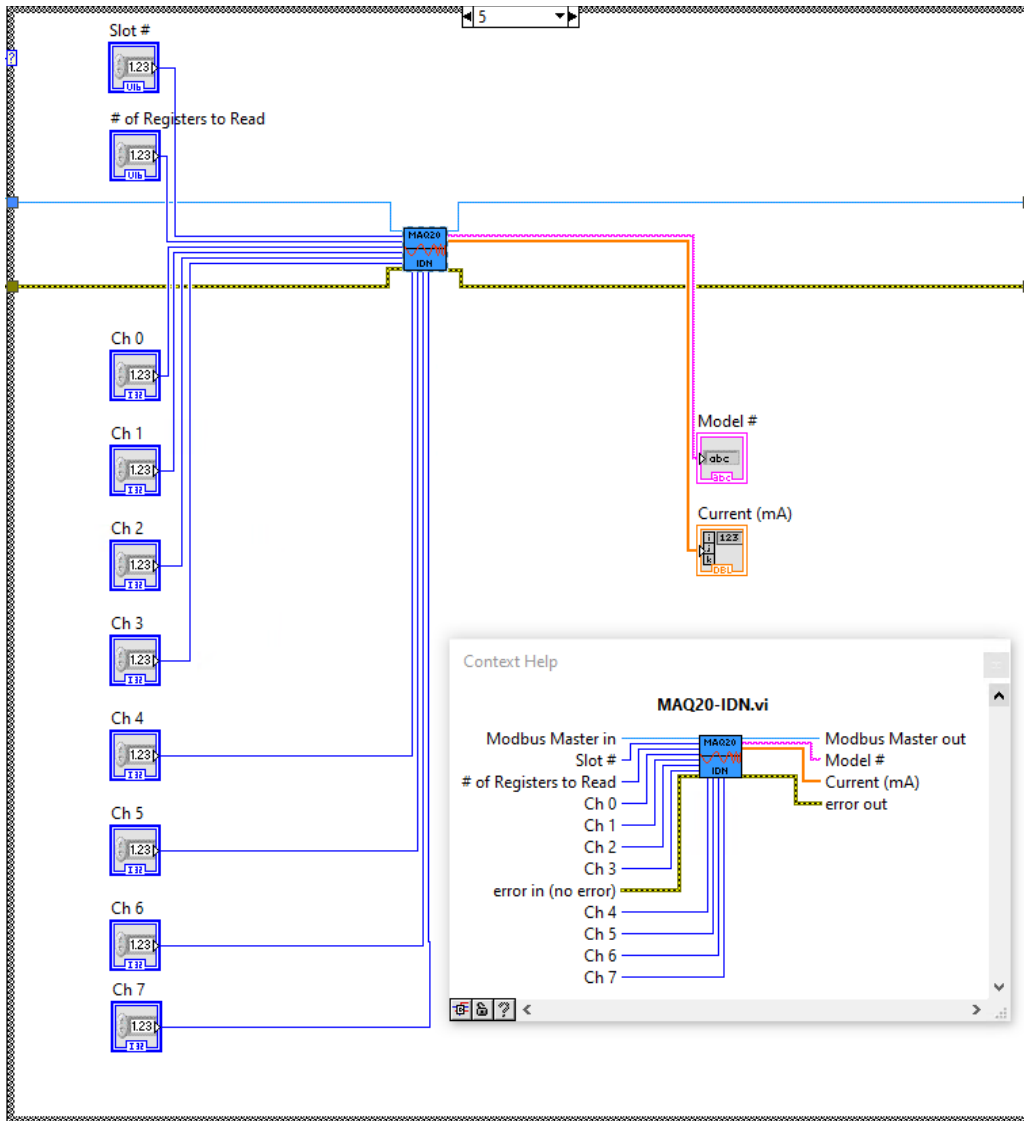


Figure 21: MAQ20-IDN VI added to the 5th position in case structure and wired to inputs and outputs.

Once all connections have been made to the VI in the Block Diagram, the values associated with the controls for “slots to scan” and “slot number” on the Front Panel need to be updated to accommodate the for the added module VI.

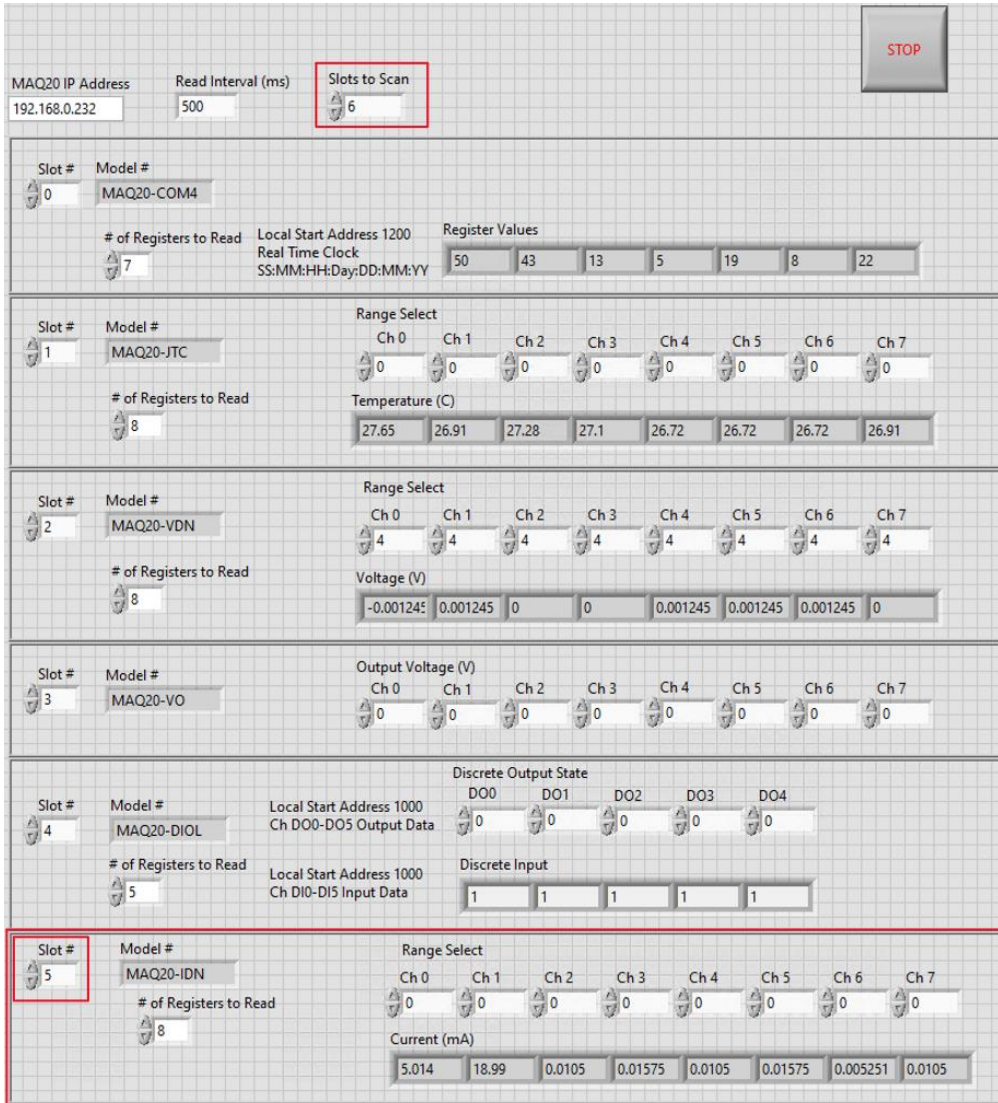


Figure 22: Front Panel updated to accommodate the VI for the added module.

13.2 Removing an Existing Module from the Example VI

Open the MAQ20 IO Module Interface TCP Example VI in LabVIEW and navigate to the Block Diagram by selecting Window > Show Block Diagram from the drop-down menu.

In the Block Diagram, use the case selector icons to navigate to the case statement that contains the module VI that is to be removed from the system.

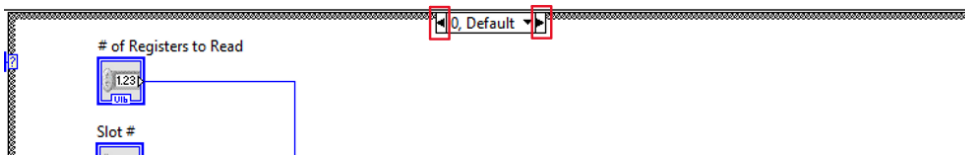


Figure 23: Case Selector Icons in Block Diagram of MAQ20 IO Module Interface Example VI

Once on the specified case statement, right click anywhere on the case display/selecter and select “Delete This Case” from the drop-down menu.

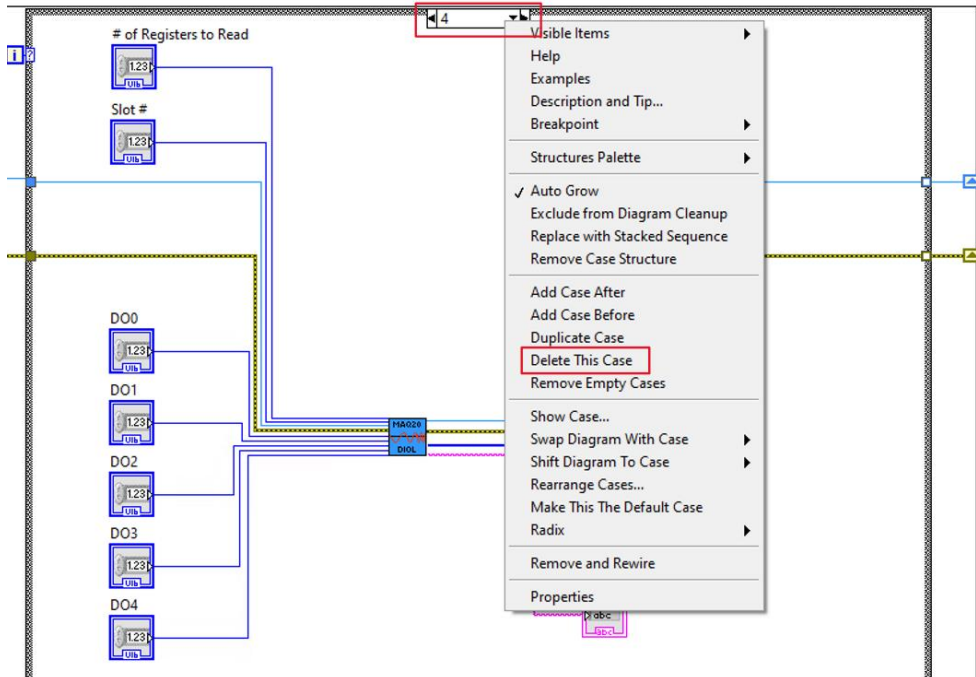


Figure 24: Removing the MAQ20-DIOL module from the system by deleting case #4 from the case structure.

Return to the Front Panel view by clicking Windows > Show Front Panel. Delete any remaining text associated with the removed module and update the number of slots to scan to one less than its previous value.

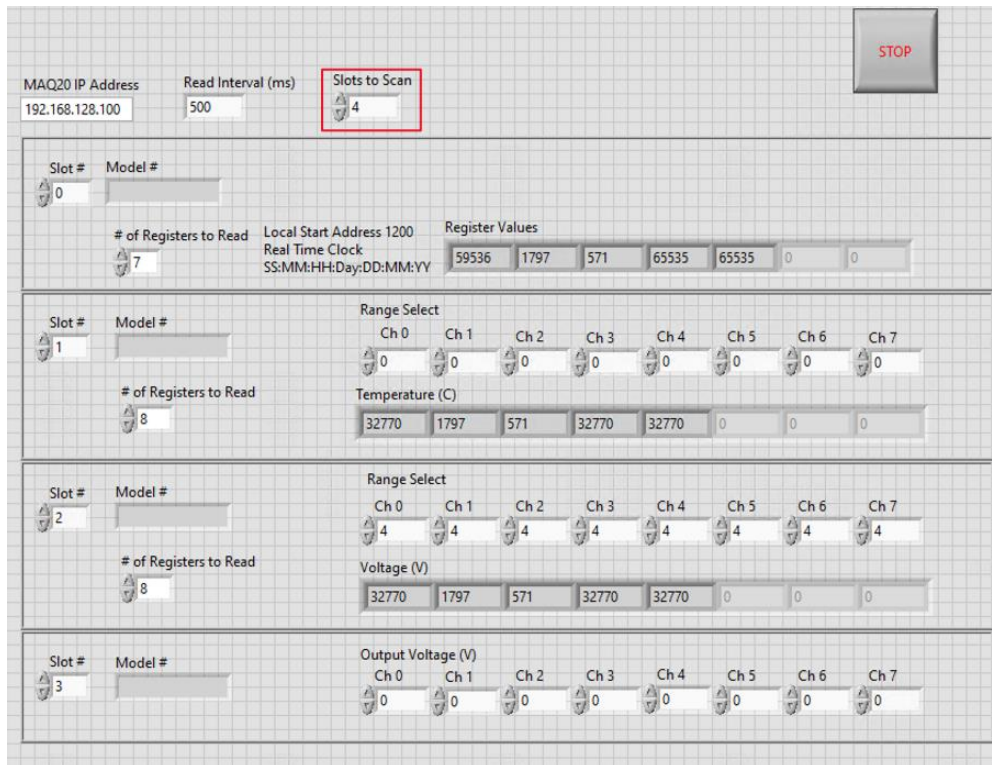


Figure 25: Front Panel with MAQ20-DIOL Module Interface Removed.

14.0 References

[Dataforth MAQ20 Software Download Center](#)
[ReDAQ Shape Software for MAQ20](#)
[MAQ20 Hardware and Software User Manuals](#)

National Instruments, LabVIEW
www.ni.com/getting-started/labview-basics/

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