

Mach3 and Modbus

A basic Introduction

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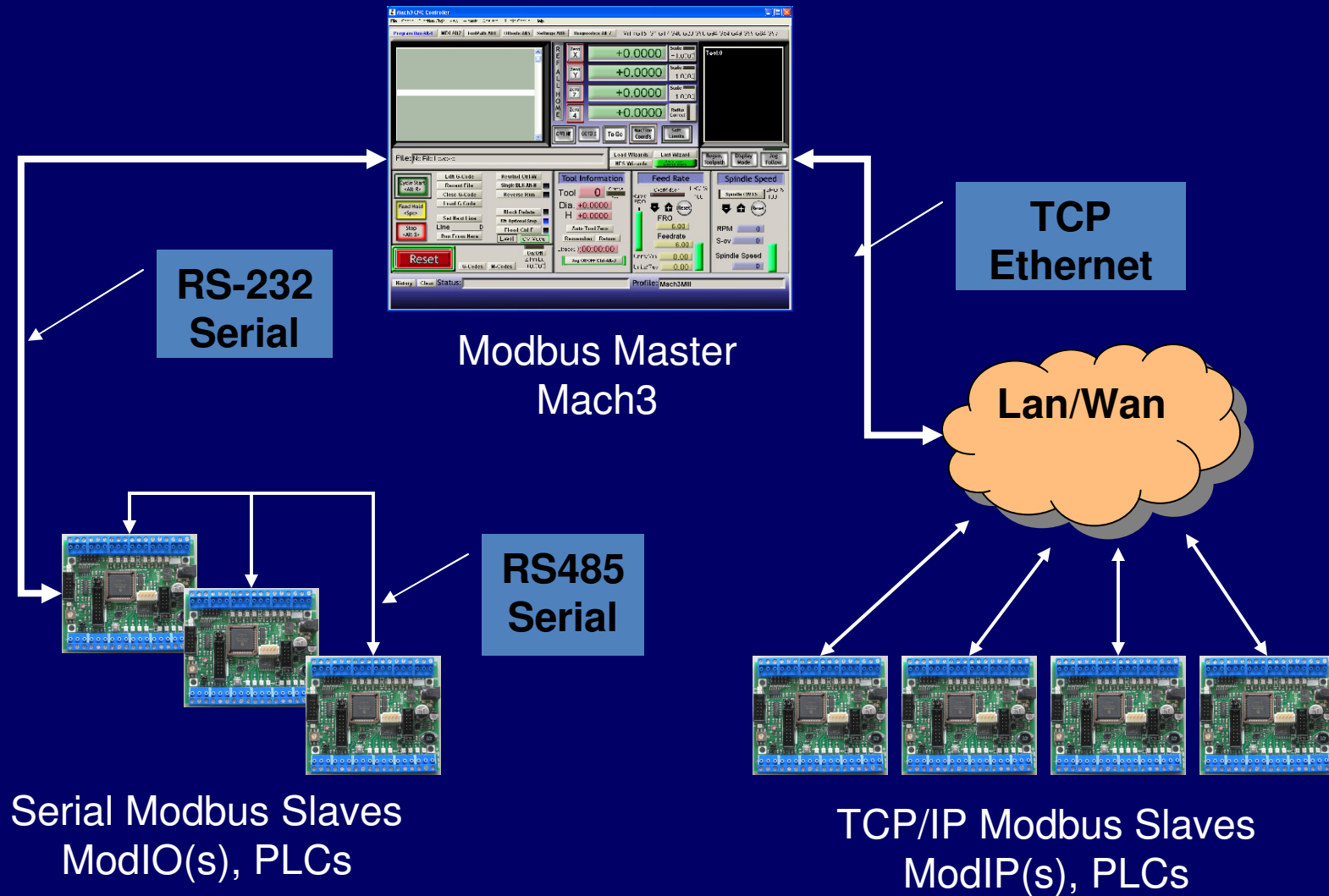
Mach3 and Modbus Introduction

- What is Modbus
- How to Setup Modbus in Mach3
- How to use Modbus in Mach3
- Practical Example

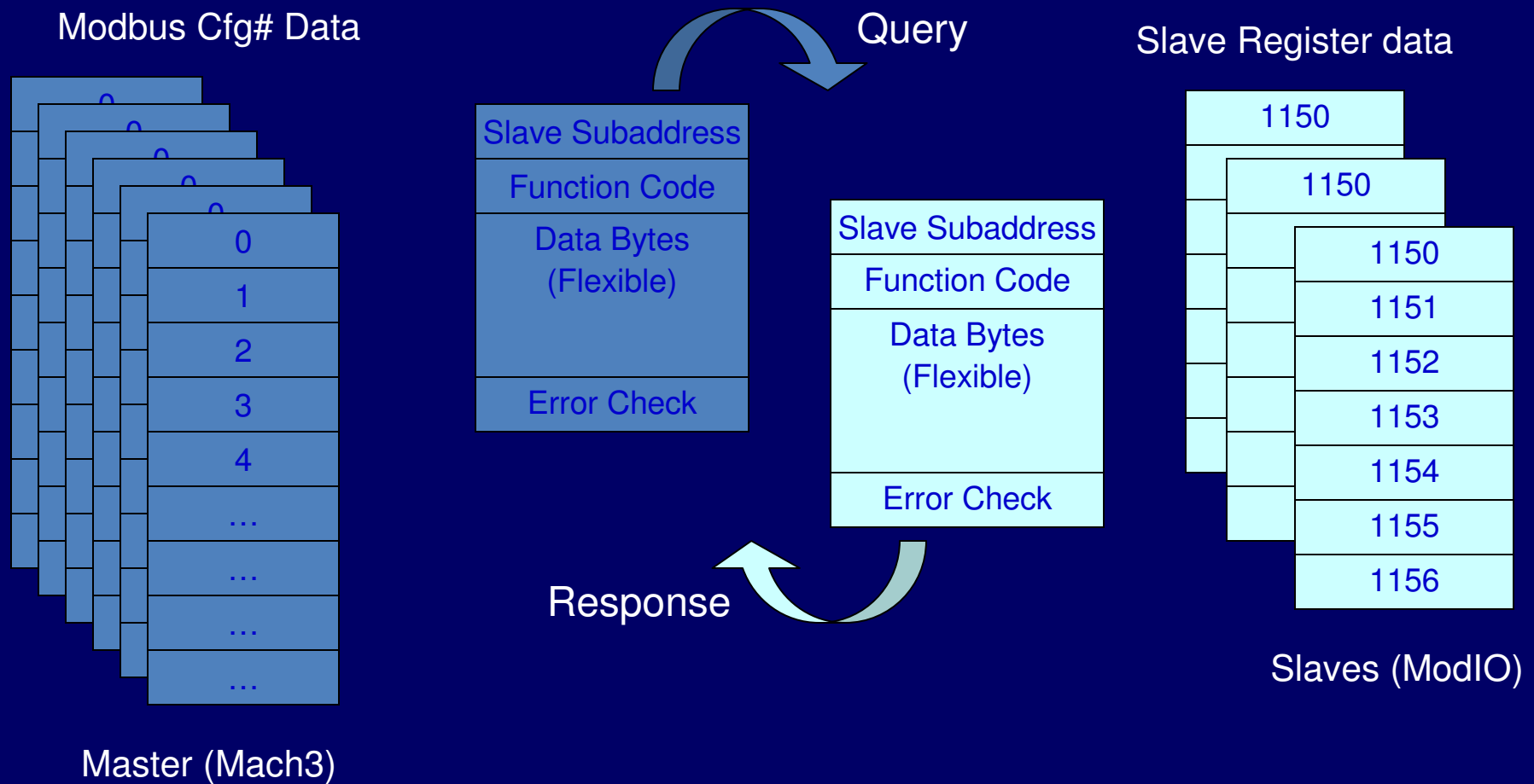
What is Modbus ?

- An open data communication protocol
- Open structure <http://www.modbus.org>
- Flexible
- Widely known
- Serial transmission modes:
 - ASCII (Not used by Mach3)
 - RTU (Binary)
- Communication interface
 - RS-232/485
 - Ethernet (TCP/IP)

Architecture Overview



Query Response Cycle



Serial RTU Message Packet

Start	Slave Address	Function Code	Data	Error Check	End
3.5 Char	1 Char	1 Char	n Chars	2 Chars	3.5 Chars
Silence				CRC	Silence

Start message detection protocol is 3.5 characters of Silence
Error Checking is by 16 bit CRC
Up to 252 Data bytes per packet
End message detection protocol is 3.5 characters of Silence

Mach3 Modbus Function Codes

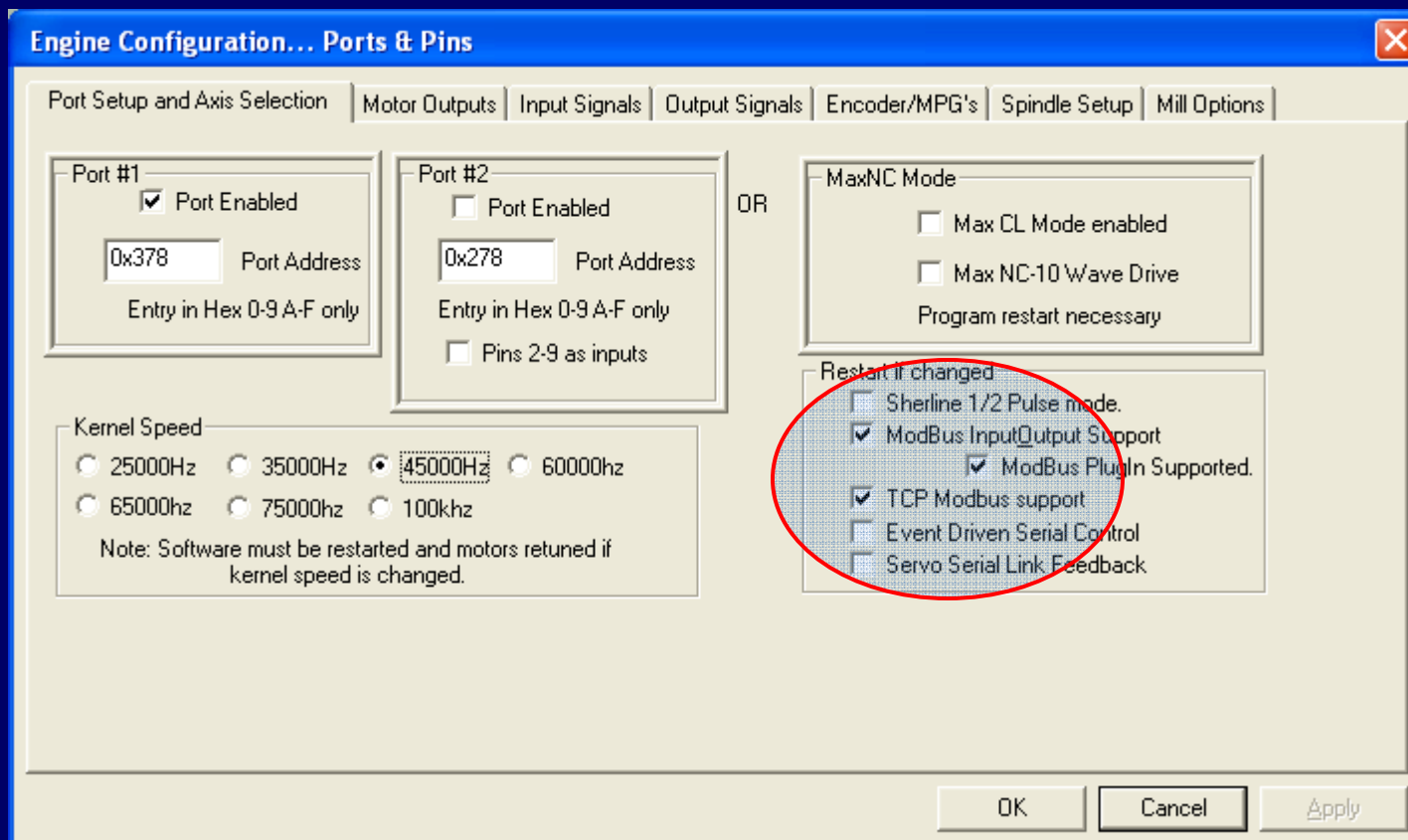
- | | |
|--|------------------------------|
| •01: read Discrete Outputs (Coils) | State of output LED |
| •02: read Discrete Inputs | Switch inputs |
| •03: read Holding Registers | Analog inputs |
| •04: read Input Register | Analog inputs, Switch arrays |
| •05: write single Discrete Output (Coil) | Relays, LEDs, etc |
| •06: write single Register | PWM Value |
| •15: write Multiple Discrete Outputs (Coils) | LED Arrays |
| •16: write Multiple Registers | PWM Values |

How to Setup Modbus in Mach3

Methods

- Standard Serial Modbus
 - Legacy Modbus support initially for ModIO device
 - Internal interface between Modbus and I/O
 - Cannot work with Plugins
 - Likely to be removed in Mach4
 - Cannot interface with Mach3 Brains directly
- Plugin Supported Serial Modbus
 - Can work with Plugins,
 - Much more flexible
 - Way of the future
 - Can be controlled by brains and Macropump
- Plugin Supported TCP Modbus
 - Same as Plugin Supported Serial Modbus but over TCP
 - Faster Comms and more expandable

Enabling Modbus Modules



Serial Modbus Comms Setup

Serial Port

Baud rate

Data Format

Modbus
Timeout

Important!!!
Modbus Enable

Modbus Configuration

Port Num: Baud Rate: ☐ Use RTS for transmit (RS485) Timeout: ms

☒ ModBus Run

	Enabled On/Off	Comment or Device	Port/Address	Slave # 0-10	Refresh 25ms Incr.	Address ModBus(Var)	# of Registers	Direction Input Output
Cfg #0	<input type="checkbox"/>		1	1	50	0	1	Input Reg
Cfg #1	<input type="checkbox"/>		1	1	50	0	1	Input Reg
Cfg #2	<input type="checkbox"/>		1	1	50	0	1	Input Reg
Cfg #3	<input type="checkbox"/>		1	1	50	0	1	Input Reg
Cfg #4	<input type="checkbox"/>		1	1	50	0	1	Input Reg
Cfg #5	<input type="checkbox"/>		1	1	50	0	1	Input Reg
Cfg #6	<input type="checkbox"/>		1	1	50	0	1	Input Reg
Cfg #7	<input type="checkbox"/>		1	1	50	0	1	Input Reg
Cfg #8	<input type="checkbox"/>		1	1	50	0	1	Input Reg
Cfg #9	<input type="checkbox"/>		1	1	50	0	1	Input Reg
Cfg #10	<input type="checkbox"/>		1	1	50	0	1	Input Reg
Cfg #11	<input type="checkbox"/>		1	1	50	0	1	Input Reg
Cfg #12	<input type="checkbox"/>		1	1	50	0	1	Input Reg
Cfg #13	<input type="checkbox"/>		1	1	50	0	1	Input Reg
Cfg #14	<input type="checkbox"/>		1	1	50	0	1	Input Reg
Cfg #15	<input type="checkbox"/>		1	1	50	0	1	Input Reg
Cfg #16	<input type="checkbox"/>		1	1	50	0	1	Input Reg
Cfg #17	<input type="checkbox"/>		1	1	50	0	1	Input Reg

Serial Modbus Test Page

Serial Port

Baud rate

Device
Sub address

Modbus
Command

Message
Refresh rate

The screenshot shows the 'ModBus Serial Control Monitor' window. It has a blue title bar and a light beige background. The 'Comm. Port' section at the top contains a 'Port Num:' field with the value '1', a 'Baud Rate' field with '57600', and 'Close' and 'Open' buttons. Below this is the 'Test' section, which includes 'Slave Addr:' (6), 'Start' (1150), and 'Num Regs:' (7). The 'Access' section has four radio buttons: 'Input Register(s)', 'Holding Register(s)' (which is selected), 'Coil(s)', and 'Discrete Input(s)'. There are 'Read' and 'Write' buttons next to these. The 'Format' section has two radio buttons: 'Hex' (selected) and 'Decimal'. Below these are 'Report Slave ID' and 'Read Excp Stat' buttons. A 'Status:' field shows 'No error'. A 'Data:' field is on the right, with a large empty area for message data. At the bottom is an 'OK' button. Red arrows point from text labels on the left and right to various elements in the window.

Important!!!
Open/Close
Serial Port

Message
Data area

Status line

TCP Modbus Test Page

Slave
IP Address

Device
Sub address

Modbus
Command

Message
Refresh rate

ModBus Serial Control Monitor

Master Address: 192 . 168 . 110 . 224 Close Open

Test

Slave Addr: 255 Start: 1020 Num Regs: 10

Access

☐ Input Register(s) ☒ Holding Register(s) ☐ Coil(s) ☐ Discrete Input(s)

Read Write

Format

☒ Hex ☐ Decimal

Report Slave ID Read Excp Stat

Status: No Error

Data:

0168
0051
017E
01C3
01C3
0000
0000
0000
0000
0000

OK

Important!!!
Open/Close
TCP Port

Message
Data area

Status line

Modbus Message Config Setup

Read 8 holding registers
from slave 3 every 50mS

Read 1 holding register
from slave 3 every 50mS

Read 8 holding registers
from slave 4 every 50mS

Read 1 holding register
from slave 4 every 50mS

Modbus Configuration

Port Num: Baud Rate: ☐ Use RTS for transmit (RS485) Timeout ms

☒ ModBus Run

Cfg #	Enabled On/Off	Comment or Device	Port/Address	Slave # 0-10	Refresh 25ms Incr.	Address ModBus(Var)	# of Registers	Direction	
								Input	Output
Cfg #0	<input checked="" type="checkbox"/>	ModIP 1	1	3	50	1,150	8	Input	Holding
Cfg #1	<input checked="" type="checkbox"/>	ModIP 1	1	3	50	1,140	1	Output	Holding
Cfg #2	<input checked="" type="checkbox"/>	ModIP2	1	4	50	1,150	8	Input	Holding
Cfg #3	<input checked="" type="checkbox"/>	ModIP2	1	4	50	1,140	1	Output	Holding
Cfg #4	<input type="checkbox"/>		1	1	50	0	1	Input	Reg
Cfg #5	<input type="checkbox"/>		1	1	50	0	1	Input	Reg
Cfg #6	<input type="checkbox"/>		1	1	50	0	1	Input	Reg
Cfg #7	<input type="checkbox"/>		1	1	50	0	1	Input	Reg
Cfg #8	<input type="checkbox"/>		1	1	50	0	1	Input	Reg
Cfg #9	<input type="checkbox"/>		1	1	50	0	1	Input	Reg
Cfg #10	<input type="checkbox"/>		1	1	50	0	1	Input	Reg
Cfg #11	<input type="checkbox"/>		1	1	50	0	1	Input	Reg
Cfg #12	<input type="checkbox"/>		1	1	50	0	1	Input	Reg
Cfg #13	<input type="checkbox"/>		1	1	50	0	1	Input	Reg
Cfg #14	<input type="checkbox"/>		1	1	50	0	1	Input	Reg
Cfg #15	<input type="checkbox"/>		1	1	50	0	1	Input	Reg
Cfg #16	<input type="checkbox"/>		1	1	50	0	1	Input	Reg
Cfg #17	<input type="checkbox"/>		1	1	50	0	1	Input	Reg

How to use Modbus in Mach3

Mechanisms

- MacroPump
 - Runs ~10 times per second
 - Will work directly with legacy serial mode
 - Can interface with Mach3 Brains via User DROs
- VB macros
 - Will work directly with legacy serial mode
 - Can interface with Mach3 Brains via User DROs
- Mach3 Brains
 - Interfaces directly with Plugin Supported Modbus
 - Can interface with Macropump via User DROs
- Mach3 Plugin
 - Interfaces directly with Plugin Supported Modbus
 - Need C++ Programming skills

Mach3 Brains

- Brains are run ~ 10 times per second
- Extremely fast
- Graphical editor
- Real-time monitoring of inputs and outputs
- Video tutorials at: <http://www.machsupport.com/videos.php>

Brain Control Form

List of
Brains

Brain Control

Loaded Brains

- DisableLPT2.brn
- EnableLPT2.brn
- Modbus_MPG2.brn
- ModIOMPG.brn
- ModIO_MP-02.brn
- MPG.brn
- Offset LEDs.brn
- PWM-ModIO.brn
- Spindle OR LED.brn
- ToggleMPGmode.brn

☐ Enabled

Reload Brain

Reload All Brains

Enable All

Disable all

ViewBrain

Cancel

OK

Brain
Controls

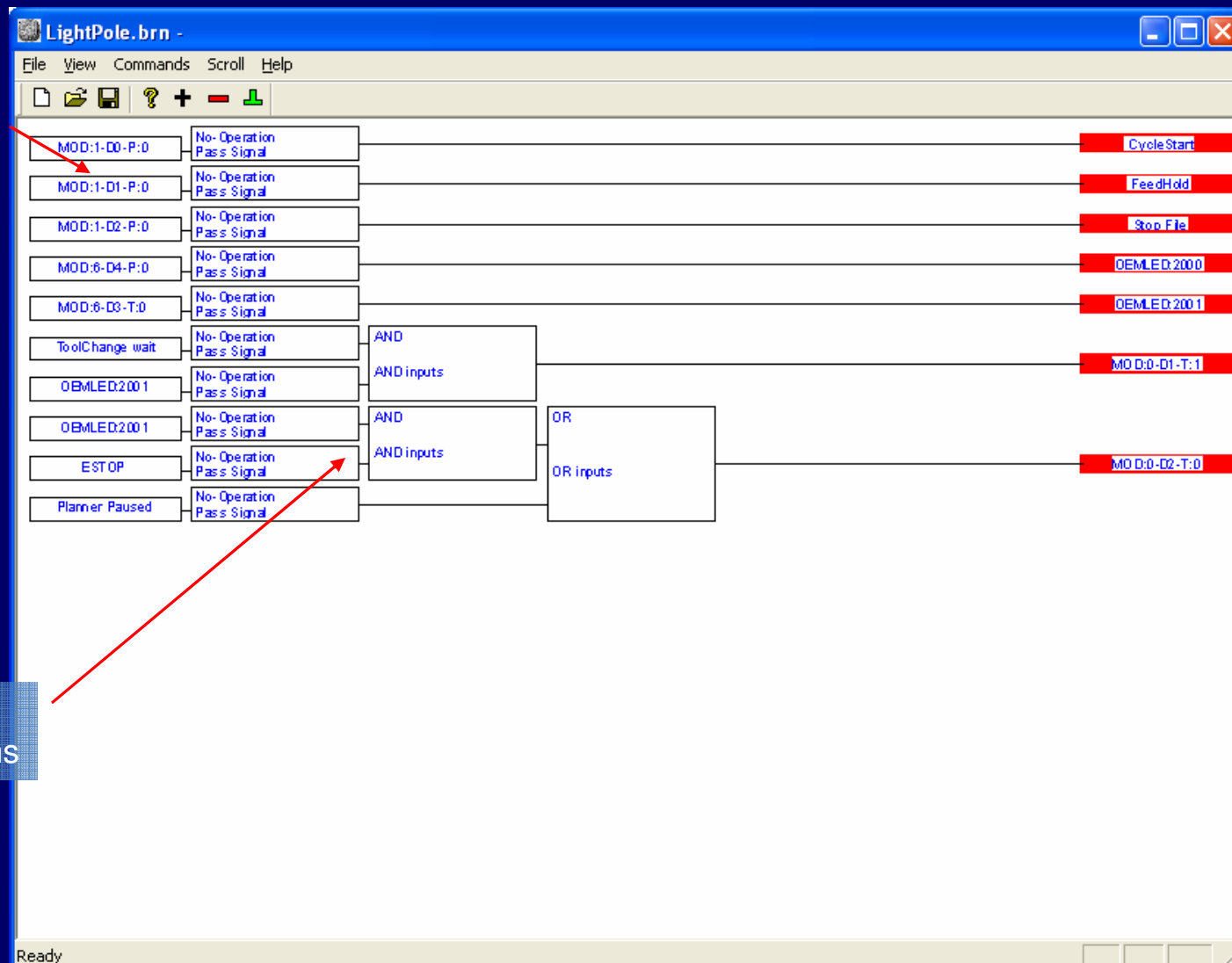
Real-time
Display

Brain Editor

Data
inputs

Data
Outputs

Data
Operations

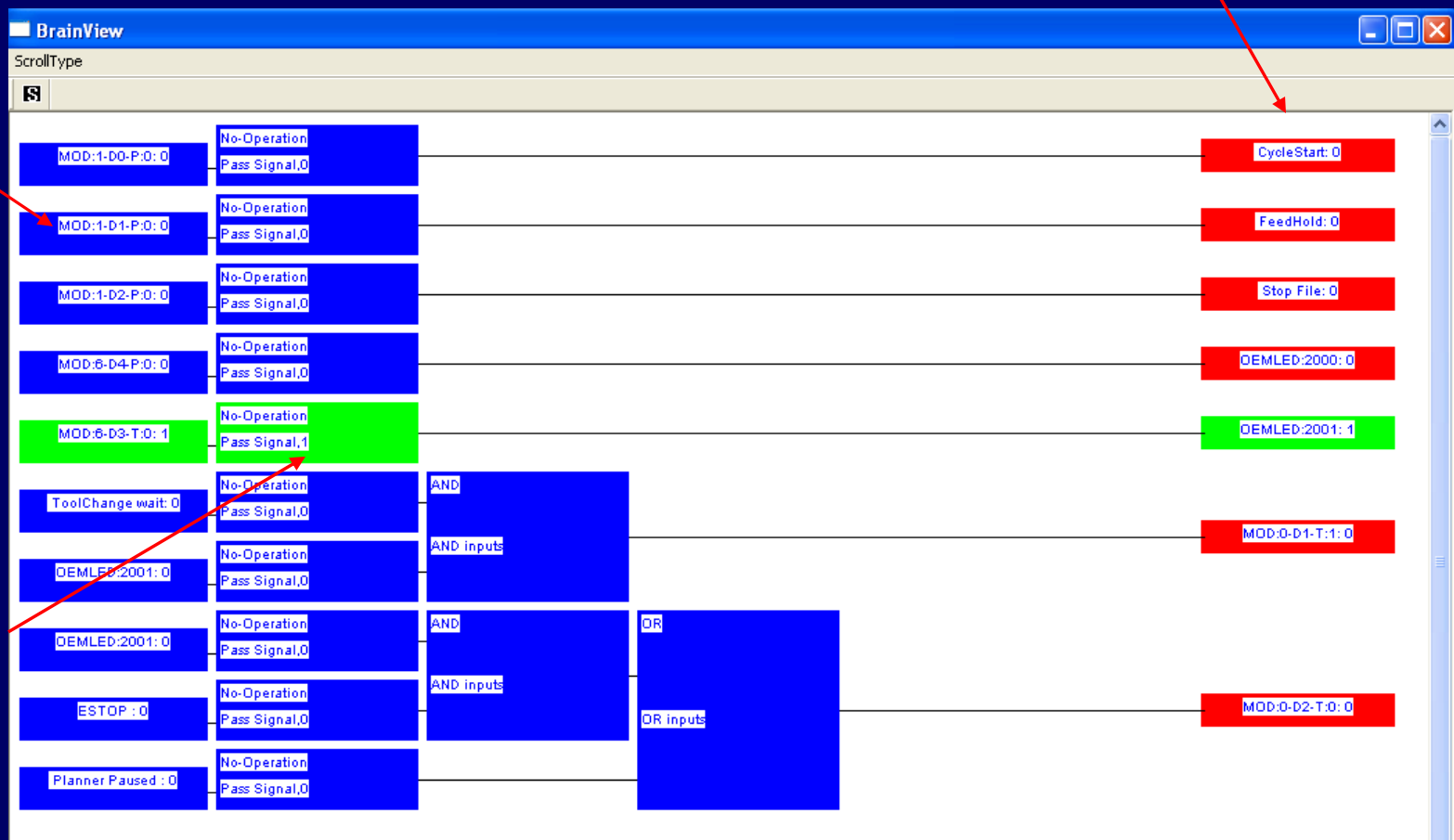


Real Time Brain Viewer

Data
Outputs

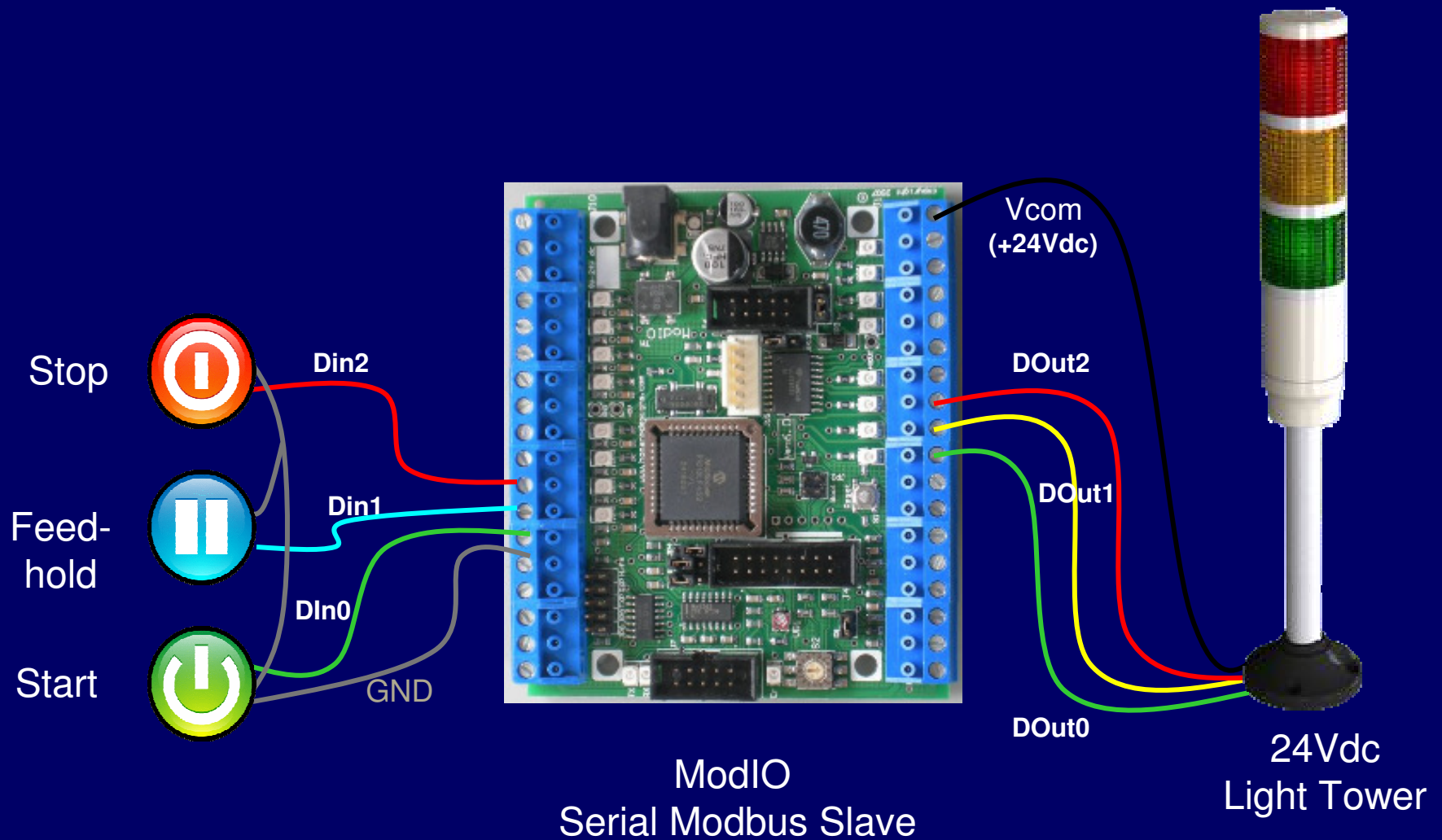
Data
inputs

Data
Operations



A Practical Example

Machine Light Tower



Resources

- Modbus Standards

- <http://www.modbus.org/>
- http://www.modbus.org/docs/Modbus_Application_Protocol_V1_1b.pdf
- http://www.modbus.org/docs/Modbus_over_serial_line_V1_02.pdf
- http://www.modbus.org/docs/Object_Messaging_Protocol_ExtensionsVers1.1.doc

- Video Tutorials

- <http://www.machsupport.com/videos/>
- http://www.machsupport.com/videos/movies/modio_setup1.wmv
- http://www.machsupport.com/videos/movies/modio_setup2.wmv
- http://www.machsupport.com/videos/movies/modio_setup3.wmv

- Modbus Examples

- http://www.machsupport.com/MachCustomizeWiki/index.php?title=Customization_case_studies
- http://www.machsupport.com/MachCustomizeWiki/index.php?title=Mach3_Pendants_links
- http://www.cnczone.com/forums/mach_software_artsoft_software/57759-mach3_modio_handheld_pendant-new-post.html

- Modbus Hardware

- Homann Designs <http://www.homanndesigns.com>
- Automation Direct <http://www.automationdirect.com.au>