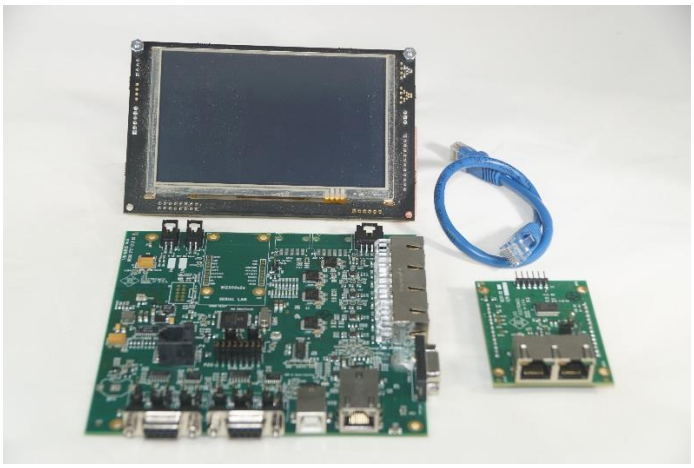


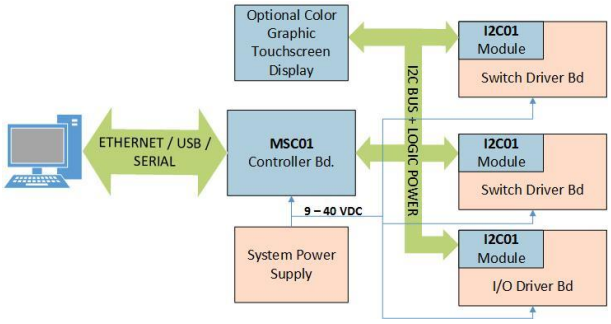
# Modular RF Switch Control System

## “Control RF Switch Matrixes up to 100 x 100 via Ethernet, USB, Serial or Touchscreen panel”

Modular System Controls has developed a modular system for OEMs to control RF switches, attenuators, synthesizers and other devices and has been producing these systems since 2014. The traditional OEM approach has been to use generic commercial off-the-shelf serial, Ethernet or GPIB digital interface boards to control their systems. These boards typically have up to 16 8-bit ports with 128 total I/O lines with a control format that may only support byte oriented commands. Most multi-position switches have one control line per pole and if indicator contacts are used there will be an additional line for each contact. If one byte is used to control each switch, a typical interface board is only capable of controlling 16 switches without indicator feedback or 8 switches with indicators. As there are up to 14 lines (including power and ground) for a common 6-position switch, an eight switch system could have a bundle of up to 112 wires which have to be hand routed and connected. Additional interface boards could be added to increase the number of switches, but this only complicates any control software and there is no simple provision for local front panel control. To add to the complexity, if the switches do not have TTL compatible inputs, additional driver circuitry will need to be added to handle the coil voltages and inductive spikes.

Some OEMs have built backplane boards to handle decoding, interconnections and interfacing using ribbon cables to connect to the interface board. However there are reliability issues with ribbon cables, especially in military or other high-reliability systems. The Modular System Controls approach is to use distributed processing. A small module about the size of a credit card containing a low cost

microcontroller is placed on each backplane board and is connected to the System Control Board via a standard off-the-shelf Ethernet cables using the industry standard $I^2C$ protocol. The modules have 2 connectors to support daisy chaining of the cables. An example switch driver board is shown in the picture. Each $I^2C$ bus can support up to 112 modules. The modules use a standard SPI bus to control 16-bit I/O expander chips on the backplane boards which will support up to 32 expander chips or 512 I/O lines per module. The System Control Board has 3 $I^2C$ interfaces which results in a practically unlimited number of I/O lines. The module's standard firmware supports 1-of-N type switches, binary encoded switches, latching switches (pulsed outputs), attenuators and parallel I/O for relays, LEDs, front panel switches, and many others. Verification of switch connections can be enabled using indicator lines. Synthesizers and other devices can be controlled via the SPI bus, a serial port or a second $I^2C$ interface on the module.


The MSC02 System Control Board is the heart of the system. In addition to the 3 $I^2C$ buses, it supports TCP/IP Ethernet, USB and serial (RS232, RS422 & RS485) remote control using IEEE-488.2, SCPI and MODBUS protocols. Local HMI control is provided by an optional full color 800 x 400 pixel touchscreen panel which is also controlled by the $I^2C$ bus to provide individual switch control, matrix control, attenuator control and setup from the front panel. In addition, an embedded web server provides configuration and control via a web browser. With intuitive configuration commands, the EOM can quickly configure a switch matrix of up to 100 x 100 with up to 6 levels of switches in each path. The matrix connections are then made with a simple high level SCPI command: ROUTe:MATrix x,y. The System Controller Board runs off of the system power supply (9-40VDC) and provides logic power for the I/O boards. Additional chassis can be controlled by the Controller's RS422 or RS485 ports.

**Modular System Controls**

**ModularSystemControls.com**