Opus-Two

INSTRUMENT CONTROL SYSTEMS

Welcome to the Opus-Two family! The Opus-Two Instrument Control System is one of the most versatile, flexible, and certainly one of the fastest control systems available. Before you do anything, please take the time to read this entire document. Many of your initial questions will be answered in these pages.

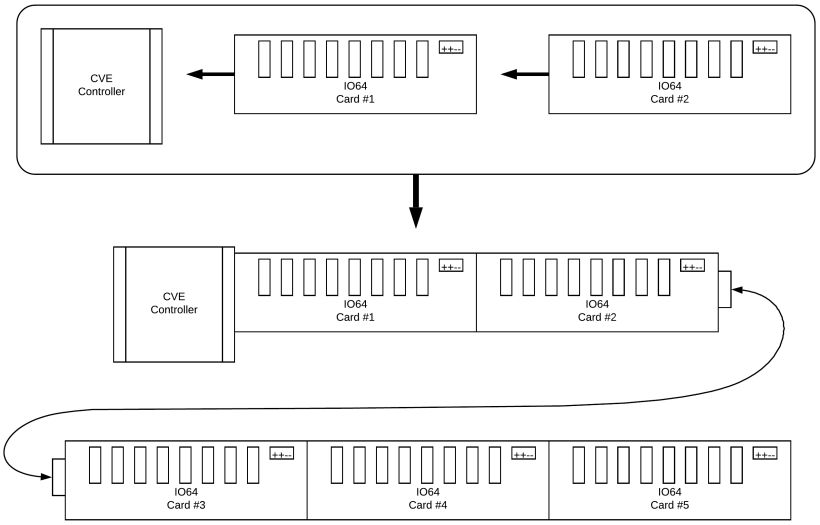
The control system in this box is a bit like a jig-saw puzzle, but unlike a jigsaw puzzle, this one has piece by piece directions. If this is your first control system, we strongly suggest getting the console up and running first before even starting to build chamber panels, this will provide all the knowledge you need to work in the chambers.

You will not have a "programming cable" per se with this control system. The controllers use standard micro-USB cables (the same as an android smart phone charger).

Take the time to familiarize yourself with the terminal interface in the console controller. This is a self-exploration that should be done at any time. By simply plugging into that controller with a USB cable, it will power up and you can immediately connect to it with a computer (instructions are contained within this book).

An online video series will be available at www.opustwoics.com starting in the summer of 2020 that will expand upon the information found in this guide.

Laying Out The Card Chain

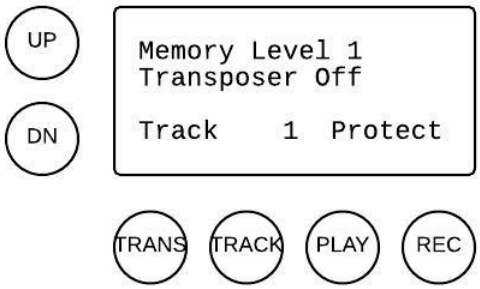


The controllers and I/O cards get plugged together to make chains. Refer to your documentation to know how long to make the console chain. The console will get one controller and the appropriate number of I/O cards. If the controller cards have come pre-programmed, use the one marked "Console." The I/O cards are known by their relative position in the chain – the first card after the controller is card 1, next card is card 2, etc. Any time you need to make a new row, simply use the Extender Card Kits with the cables provided. The cables look like off-the-shelf Ethernet cables – they're not. Never substitute your own cables – if you need a different length, just let us know. We will gladly send them to you. Make sure you firmly seat the cable inside the connector, sometimes they click twice before being fully inserted. Please note that the drawing shows a legacy C-IV controller, but the concept applies the same with any controller.

NEVER unplug a card from the chain while the power is on. This will damage both cards.

Locate and Install The Display

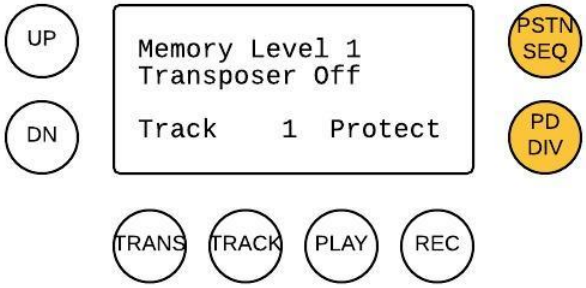
The display will get its “control buttons” mounted around it. These are typically engraved pistons with no lamps. If Walker pistons are used and they are being plugged into the display board, negative output is required for these particular pistons.



The pistons shown on the drawing at right are connected to the back of the display. No other pistons are connected there. See the CVE/CVA wiring diagram for more information in your wiring guide.

Generally, the pistons should be arranged as shown in the drawing. This allows the easiest interface and takes into account various buttons that must be pressed together. As tempting as it may be to integrate the various buttons in piston slips, this makes the control system extremely frustrating to use. Separate (additional) pistons can be integrated into piston slips, such as “Mem Up” , “Mem Dn” , “Track Up” , “Track Dn” , “Transpose +” , “Transpose -” , or any combination of the above. Piston sequence buttons (previous and next) are also typically in the piston slips and not with the display.

Please note: When retrofitting an existing console with a new control system, sometimes it is desirable to add a few controls at the display. The example on the right shows two lit pistons controlling the piston sequencer and Pedal Divide. It is worth noting that the additional pistons require separate wiring to an I/O card, so it is likely that a different polarity must be used (most I/O cards are positive I/O and the display backplane is negative input).



The display wires back to the controller with a 3-wire connection. This doesn’t require anything special, normal 24 gauge hook up wire can be used.

Wiring the I/O Card Chain

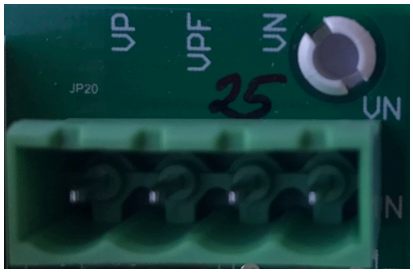
Each I/O card (and the controller card) gets wired to power and ground. These DC connections connect the green power connectors on the card to the console power distribution (not normally provided).

NEVER attempt to power up a console until all I/O card power connections have been completely connected.

On the controller card, there are only two connection points (polarity is silkscreened on the card).

For IO64-LED cards (green PCB):

On the I/O cards, there are four power terminals: VP/VPF/VN/VN. The two VN terminals are linked and therefore interchangeable ground/common wires. The VP terminal is a fused feed (in other words, the power goes through an on-board fuse before being sent out the drivers; this is good for almost every card in the console). The VPF terminal bypasses the internal fuse (past fuse) and allows larger amounts of current to surge quickly without risking an intermittent polyfused trip. In other words, connecting positive voltage to the VP terminal uses the internal fuse, and connecting it to VPF bypasses the internal fuse. One or the other should be used, not both.



Tip: If a unit rank cuts in and out when being played with lots of unification and coupling, it is probably tripping the internal polyfuse. Any time an internal polyfuse trips, an LED illuminates in the upper left corner of the card to indicate that it had tripped. The LED remains illuminated even after the fuse resets itself. Be aware the polyfuse self-reset can take a few seconds to complete.

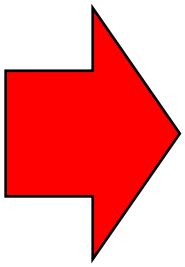
Fusing Requirements

We suggest fusing the positive side of each I/O card with a glass fuse. These fuses exist only protect against an otherwise catastrophic short circuit, such as a solder blob on the card, reversed polarity, component meltdown, etc. The negative wires to the cards should never be fused.

We suggest that any common (return) wires from a load (such as coils or chest magnets) should be fused in 6A groups per NEC. This generally means that no more than 12 stop action coils per fuse. Switches providing input back to the I/O card can have more on a single fuse, but never put more on a fuse than you would want to stop working if the fuse would blow. For example, electrically speaking, you could connect all key common wires to one fuse. But if a short circuit occurred inside a keyboard, you would want the other keyboards to continue to play, so you should use a separate fuse for each keyboard. Similarly, despite the fact you could technically use a single fuse for all stop sense supplies, you shouldn't.

For HC64-LED cards (red or black PCB):

These cards have internal fusing and the power connector simply has two positive terminals and two negative terminals. We suggest connecting an AWG14 wire to each terminal and taking it back to a junction bar (2 positive wires and 2 negative wires). You may choose to fuse the card itself with a large fuse (15A-25A) for safety sake. Common return fuses are not desired with these HC cards because of the robust power management on the card.



It is important to identify the Authority Having Jurisdiction (or AHJ). Some pipe organ wiring projects are required to be inspected by a code inspector (AHJ). We provide suggestions for fusing in DC circuits, and the AHJ will provide requirements. Always err on the side of overprotection when a conflict arises. If in doubt, contact us for additional clarification. This document is not a code book and should not be treated as one. In the event of conflicts, we can and will work with your AHJ.

Power Supply

Just about any capable industry-standard power supply will do, but some are better than others. Many Opus-Two systems are running on generators without problems, many run on ripple-laden power supplies from the 1970s, and many are running on modern Astrons and switching power supplies. We officially recommend Astron Power Supplies with their ground jumper cut (an internal bond between negative and earth). If you are unfamiliar with the cut procedure, we can provide additional documentation to assist. Switching power supplies will work, but are not as good and will likely not last as long as an Astron. Additionally, switch mode power supplies don't "come up" or "go down" very nicely at power up and power off, and it is possible that odd behavior can occur (stops moving for no reason, etc). This is not specific to Opus-Two, and many other manufacturers have subtle problems with switch-mode power supplies. If you do use a switch mode power supply, Opus-Two has built in software to check for a "rough power down" sequence.

For consoles, we suggest calculating size by using a rule of thumb value between ½ and 1 amp of capacity per tab. To turn the power supplies on and off, we suggest Furman CN power units, which are available on our web site and from many A/V distributors. Finally, we do recommend separate power supplies in the console and chamber. It is not necessary to bond the power supplies together so long as each location has it's own isolated controller card and I/O chain.

Connecting Console to Chambers

If your control system is so small that there is only one controller card, this section doesn't apply to you. Otherwise, on each chamber controller card is a green 3 pin connector. Connecting the 3 pin connector in the chamber to one of the 3 pin connectors in the console per the wiring diagrams. This will provide all that is needed for communication between he two locations. This green connection and wiring is known as the PipeBus connection. Pins A and B carry data; Pin C is the reference ground (Pin A is closest to the Analog In headers on a CVA; Pin A is closest to the MIDI ports on a CVE). If a chamber card doesn't have a functioning console attached, it will have all pins held off (will not chirp or burp). Consoles transmit to chambers whether they are connected or not. This means controllers can be freely unplugged from the PipeBus line and plugged back in as needed.

Many people use cat 5/cat 6 cable or even microphone cable for this. The wire pattern can be "hub and spoke" where each chamber wires back to the console and parallels at the console connector, or "daisy chain" where the signal goes to one chamber, jumps to the next, etc. or any combination of these methods. For reliability, we suggest to only using stranded cable to connect the data links.

Powering Up the Console

Before powering up the console, make sure the uSD card is installed in the controller (unlike past systems, there is no adapter – the card simply plugs into a socket on the controller).

When power is first applied, the display will have a startup message, which will be replaced with another screen as the console boots. Within a few seconds, the console should be completely up and running. The screen will say "Folder 1" or "Mem Level 1" on the top line if the console is up and running.

Checking the Basics (in the console)

Each of these steps is provided in intentional sequence, do not jump ahead or else you could skip something important that needs to be verified.

Remember that before even touching the "digital" side of the control system, you can use the LEDs on the cards to verify individual items (such as key contacts, stop sense lines, etc.)

1) Does the display show "Memory Level" and/or "Track" on it? If not, verify that the controller card has 12 volts and ground connected to it (use a volt meter). If it does and you still have a blank screen (or any screen other than the correct one), turn off power and diagnose the 3 wire connection between the C-IV controller card and the display.
2) Once the display has the correct screen on it, press the "Up" and "Down" buttons and verify that the memory level changes with the button presses. If it doesn't, look closely at the wiring between the buttons and the display. Make sure that the buttons are connecting 0V (ground) to the pins on the back of the display. Once the up and down buttons are functional, try one quick press on the transposer button, then use the up and down buttons. Does the transposer then go up and down? If not, figure out which button puts the up/down into transposer mode. That wire should be connected to the transpose button.
3) Once the transpose button is squared away, hold down track and press up. The track should increase. If it doesn't, then work your way around the buttons until you figure out which button (when held) makes up/down change the track.
4) Once the display is verified to be properly functioning, get to the home screen (if you have somehow wandered to a different screen, just press the reset button on the console controller). Using the USB Terminal (instructions further in this book), check each card's wiring.
5) One stop at a time, turn on the stop and press cancel. If any stops don't cancel, verify that a coil is being energized by checking the LED and then figure out whether that impulse is getting to the stop coil or not. It may be helpful to make a list, you may see patterns that help identify problems.
6) Once every single stop is cancelling correctly and every single piston is wired and mapped correctly, follow the instructions in the organist manual for setting piston ranges.
7) Now test combination action. As tempting as it is, start very small and move up. Set a few stops, test. Set a few more stops, test. Eventually you can alternate between setting full registrations and general cancel.
8) At this point, it is appropriate to build chamber panels, install them, wire them, and try playing pipes from the console.