

This document captures ideas, experiences, and informal recommendations from the Yaskawa Partner Support team. It is meant to augment – not supersede manuals or documentation from motoman.com. Please contact the Partner Support team at [partnersupport@motoman.com](mailto:partnersupport@motoman.com) for updates or clarification.

## Remote Operations with Yaskawa Motoman Robots

### Introduction

For many, the teach pendant is the only method used to interact with our robots. Obviously, this restricts you to working somewhere within the reach of the teach pendant cable. However, there are several methods to send or receive information from the robot using an Ethernet connection, including functions you would normally do via the pendant. This opens the possibility of working with the robot from other places in the same building or even from another city.

This document highlights some of the methods for working with our robots over a network, pre-requisites, costs (if any) and capabilities of each.

*This is not meant to be a step-by-step “how to” manual.* Additional references are listed that describe the “how to” sections.

Networking your robots opens a world of opportunities to incorporate products and services from third parties also. We will note a few third-party products here, but the focus is on network features and products from Yaskawa Motoman.

This document captures ideas, experiences, and informal recommendations from the Yaskawa Partner Support team. It is meant to augment – not supersede manuals or documentation from motoman.com. Please contact the Partner Support team at [partnersupport@motoman.com](mailto:partnersupport@motoman.com) for updates or clarification.

## Connecting the Robot to a Network

Most of our systems support multiple Ethernet LAN connections to the controller. Connections are labelled LAN1, LAN2, and LAN3. LAN1 is reserved to be used by the pendant. LAN 2 and LAN3 connections can be configured in Maintenance Mode (System, Option Function, LAN Interface Settings). Reference material explaining the network capabilities and configuration instructions is included in the “References” section below.

You will need to coordinate the network settings for the controller with all other devices on same the network so they can communicate with each other. If this is a new network, the following settings are commonly used and will get you started:

**IP ADDRESS:** 192.168.1.31 (for the controller)

**SUBNET MASK:** 255.255.255.0

If your PC will be connecting on the same network use similar settings for your PC but pick something other than 31 for the last part of the IP Address. Every device on the same network subnet (e.g. 192.168.1.\*) must have a unique number in the last part of the IP Address.

You can have multiple robot controllers on the same network and access any / all of them from other devices on the network. Make sure each has a unique address.

### References – LAN Interface Settings

Controller	Manual Name / Link
DX100	<a href="#">Ethernet Function</a>
DX200	<a href="#">Ethernet Function</a>
FS100, FS100L	<a href="#">Controller Operator's</a>
YRC1000	<a href="#">General Operator's</a>
YRC1000micro	<a href="#">YRC1000micro Operator's Manual</a>



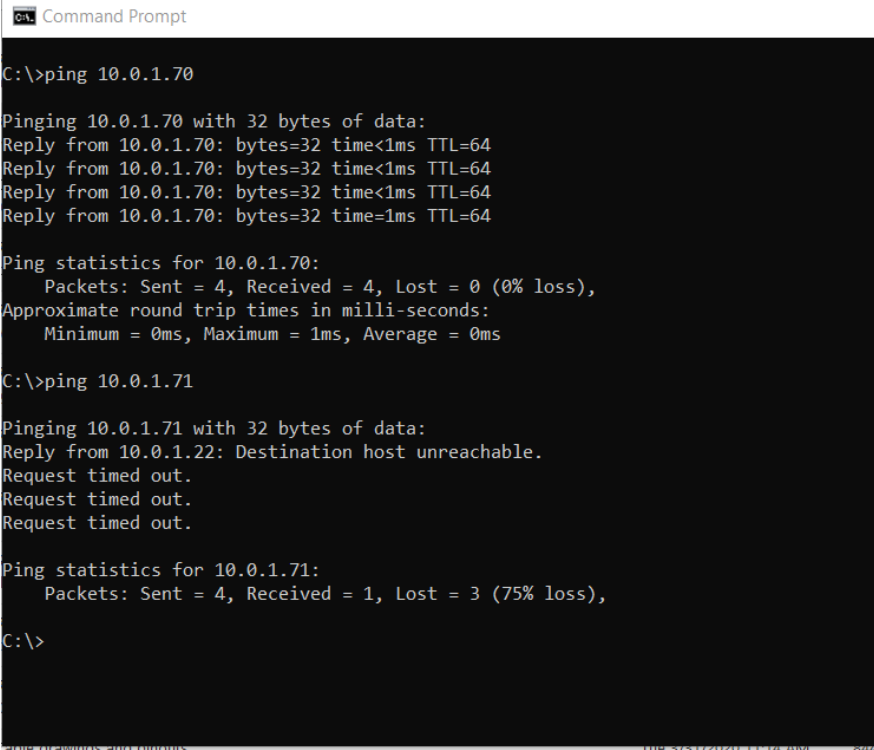
Figure 1 - Lan connections on a YRC1000

This document captures ideas, experiences, and informal recommendations from the Yaskawa Partner Support team. It is meant to augment – not supersede manuals or documentation from motoman.com. Please contact the Partner Support team at [partnersupport@motoman.com](mailto:partnersupport@motoman.com) for updates or clarification.

## Testing the Network Connection

To verify the correct network settings are in place, there is a “ping” function available on most networked systems. (The name comes from submarine active sonar terminology that sends a pulse of sound and listens for the echo to detect objects under water.) A device can send a “ping” network packet targeting other devices on the network and listen to see if there is a response and how long it takes to return.

To issue a ping from your Windows PC, open a command prompt (click on “Start”, type CMD and then press enter.) From the command prompt, enter “ping 192.168.1.31” (or the address of your controller that you entered). A successful response will begin with “Reply from “. Unsuccessful responses are “Request timed out.”



```
Command Prompt
C:\>ping 10.0.1.70

Pinging 10.0.1.70 with 32 bytes of data:
Reply from 10.0.1.70: bytes=32 time<1ms TTL=64
Reply from 10.0.1.70: bytes=32 time<1ms TTL=64
Reply from 10.0.1.70: bytes=32 time<1ms TTL=64
Reply from 10.0.1.70: bytes=32 time=1ms TTL=64

Ping statistics for 10.0.1.70:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 1ms, Average = 0ms

C:\>ping 10.0.1.71

Pinging 10.0.1.71 with 32 bytes of data:
Reply from 10.0.1.22: Destination host unreachable.
Request timed out.
Request timed out.
Request timed out.

Ping statistics for 10.0.1.71:
    Packets: Sent = 4, Received = 1, Lost = 3 (75% loss),

C:\>
```

Figure 2 - Ping from PC

This document captures ideas, experiences, and informal recommendations from the Yaskawa Partner Support team. It is meant to augment – not supersede manuals or documentation from motoman.com. Please contact the Partner Support team at [partnersupport@motoman.com](mailto:partnersupport@motoman.com) for updates or clarification.

You can also issue a ping from DX200 or YRC controllers to other devices on the network to check connectivity “outwards” from the controller. The ping command is available under SYSTEM INFO, NETWORK UTILITY if you are at Management Level security. Operation is like on a PC. You provide the target network address and select “EXECUTE” from the bottom of the screen to start the ping. Results will be displayed on the pendant.

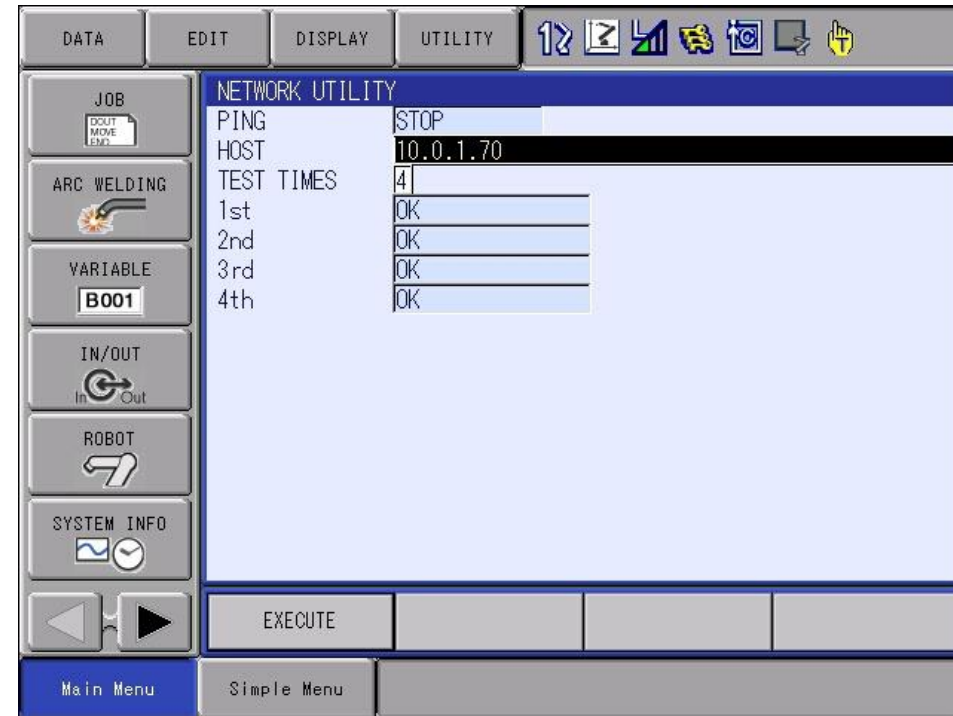


Figure 3 - Ping from Controller

This document captures ideas, experiences, and informal recommendations from the Yaskawa Partner Support team. It is meant to augment – not supersede manuals or documentation from motoman.com. Please contact the Partner Support team at [partnersupport@motoman.com](mailto:partnersupport@motoman.com) for updates or clarification.

## Tools and Functions Available via the Network

Assuming you have the controller configured correctly and a PC on the same network, now what? There are a variety of both free and purchased tools to interact with the robot controller. Some of these will be described below, as well as methods for connecting to your robot network from other locations.

For each tool, we will look at what it is, what it does, which platforms it is available on and some basic instructions for how to use them.

### Tools: Transferring Files using FTP

File Transfer Protocol (FTP) is another standard (free) TCP/IP function like ping. It is used to send or receive files from one device to another via the network. In operation, one device is an FTP “Client” which makes requests of a device acting as the FTP “Server” where the files are located. Clients send commands that servers respond to. The client can receive files from the server, send files to the server, request a directory of available files and issue other commands. Our controllers can function as an FTP server. There is an FTP client application that is included with Windows. It runs from the Windows command line. There are also numerous freeware or public domain clients for Windows that can be downloaded. These may be easier to use and configure than the native Windows FTP client. Shown, is an FTP session using the “FileZilla” Windows app.

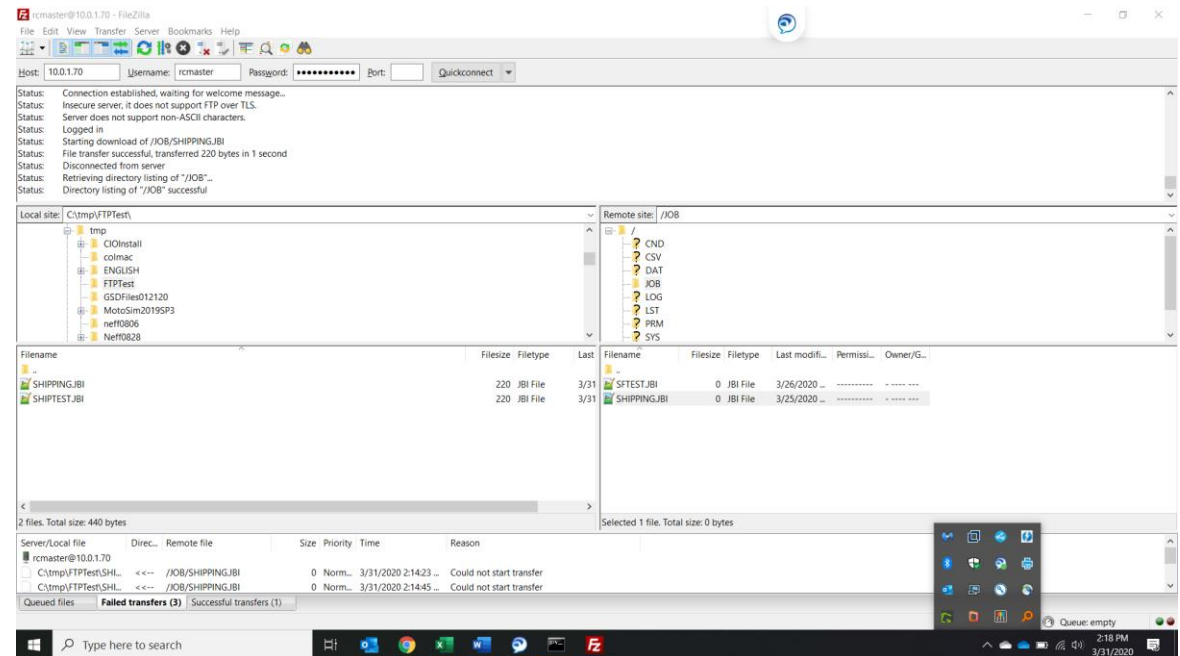


Figure 4 - FileZilla FTP Session

The FTP Server functions are available on FS100, DX100, DX200 and YRC controllers. Exact features and setup of the server varies slightly. A list of reference documents for enabling FTP on these controllers follows. TIP: Read and follow instructions carefully. Experience has shown it can be tricky to get FTP transfers working with different settings.

This document captures ideas, experiences, and informal recommendations from the Yaskawa Partner Support team. It is meant to augment – not supersede manuals or documentation from motoman.com. Please contact the Partner Support team at [partnersupport@motoman.com](mailto:partnersupport@motoman.com) for updates or clarification.

## References – File Transfer Protocol (FTP)

<b>Controller</b>	<b>Manual Name / Link</b>
DX100	<a href="#">FTP Function</a>
DX200	<a href="#">FTP Function (Ethernet Advanced Feature Function)</a>
FS100	<a href="#">FTP Function</a>
YRC1000	<a href="#">Ethernet Function</a>
YRC1000micro	<a href="#">Ethernet Function</a>

This document captures ideas, experiences, and informal recommendations from the Yaskawa Partner Support team. It is meant to augment – not supersede manuals or documentation from motoman.com. Please contact the Partner Support team at [partnersupport@motoman.com](mailto:partnersupport@motoman.com) for updates or clarification.

## Tools: Remote Pendant

YRC1000 and YRC1000Micro controllers introduced the “Remote Pendant Operation Function”. This is another free capability. Remote Pendant allows you to view a virtual pendant in an internet browser. Assuming you already have the controller configured to be on a network, the configuration of Remote Pendant includes establishing accounts for authorized users and starting a Remote Server on the controller. As with other approaches for remote operation, you will not be allowed to turn servos on or start jobs (for safety reasons.)

TIP: Users can be authorized to only view what is happening on the standard pendant (OPERATION = PROHIBIT) or to input commands as if they were using the standard pendant (OPERATION=PERMIT).

While you are in control the person at the robot can watch the pendant to see what you are doing while you are doing it. So, this can be very useful for training or support. While on the phone you can explain what you are doing while they watch.

The Remote Pendant function is available on YRC1000 and YRC1000Micro controllers. A list of reference documents for enabling Remote Pendant on these controllers appears below.

## References – Remote Pendant Operation

Controller	Manual Name / Link
YRC1000	<a href="#">General Operator's</a>
YRC1000micro	<a href="#">YRC1000micro Operator's Manual</a>



Figure 5 - Remote Pendant

This document captures ideas, experiences, and informal recommendations from the Yaskawa Partner Support team. It is meant to augment – not supersede manuals or documentation from motoman.com. Please contact the Partner Support team at [partnersupport@motoman.com](mailto:partnersupport@motoman.com) for updates or clarification.

## Tools: Software Pendant

Systems that are configured with our Smart Pendant include a Windows software application that can be run on a PC to supplement features of the Smart Pendant. There is no charge for this feature, designed to supplement the capabilities of the Smart Pendant. A copy of the software is stored on the Smart Pendant and can be downloaded to USB for installation on a PC. Once installed, running the application on the PC allows you to connect to your controller and perform most of the functions of a full standard pendant. Again, you are not able to turn servos on or move the robot for safety reasons.

TIP: Software Pendant is designed to be used with a single controller (probably directly connected) versus a network of multiple robots. It does not have a facility to choose which robot to connect to. You will need to plan your connectivity accordingly.

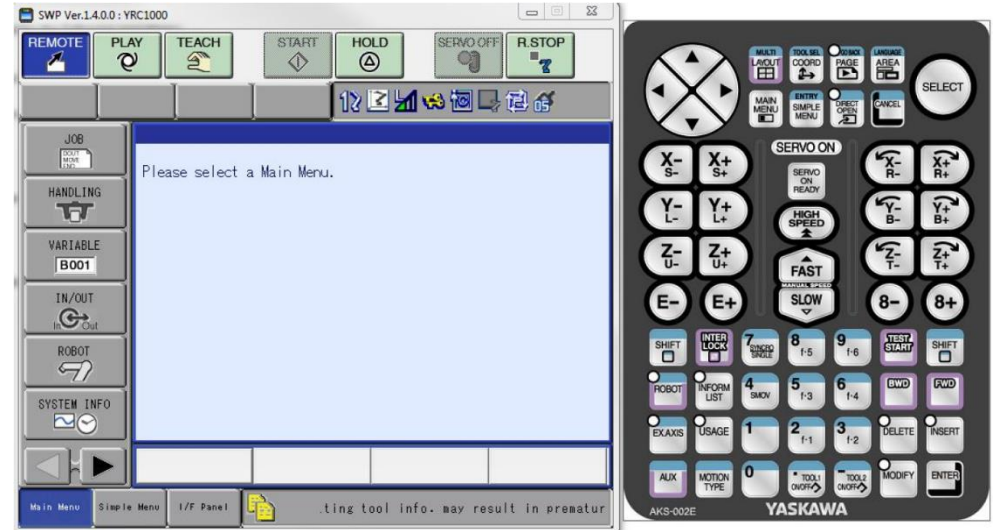


Figure 6 - Software Pendant

## References – Software Pendant

Controller	Manual Name / Link
YRC1000, YRC1000micro	<a href="#">Instructions for Smart Pendant</a>



This document captures ideas, experiences, and informal recommendations from the Yaskawa Partner Support team. It is meant to augment – not supersede manuals or documentation from motoman.com. Please contact the Partner Support team at [partnersupport@motoman.com](mailto:partnersupport@motoman.com) for updates or clarification.

## Tools: Robot Manager

Robot Manager is a Yaskawa product you can purchase to view and update robot files, monitor I/O and variables, and see the status of your controller (what job is running, whether in Teach, Remote or Play, alarms, etc.) Robot Manager works on robots that support the High-Speed Ethernet Server function. Those include: DX100 (System Software DS2.07.00A or greater), FS100, DX200, YRC1000, and YRC1000Micro.

Robot Manager maintains two levels of password protected user access: User Mode, which does not allow editing of data stored on the controller and Admin Mode, which does allow editing. Passwords are stored on the PC where Robot Manager resides.

Robot Manager allows you to define connections to more than one robot but will only connect to one at a time.

There is a powerful backup capability within Robot Manager. It can be used to automatically connect to a controller for scheduled backups using Windows Task Scheduler. You can select different files to be backed up, multiple job schedules and different backup destinations.

TIP: We have seen instances where Robot Manager is slow to respond on slow or congested networks. Check with Yaskawa for the latest release of software and configuration tips that may help address these issues.

## References – Robot Manager

Controller	Manual Name / Link
YRC1000, DX100, DX200, FS100, NX100	<a href="#">Robot Manager</a>

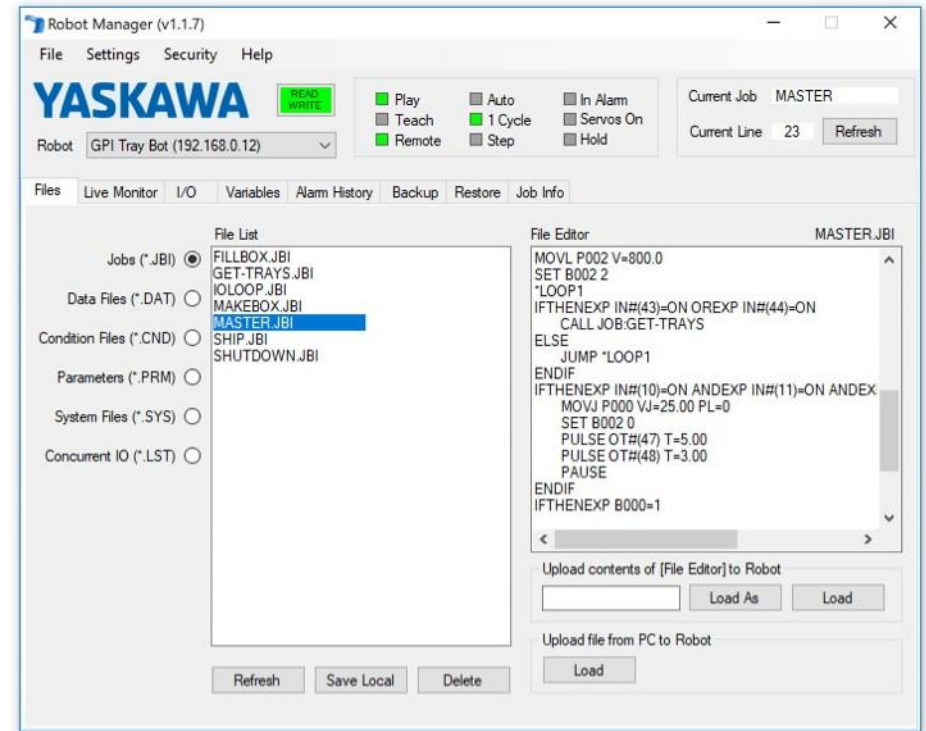


Figure 7 - Robot Manager home screen

This document captures ideas, experiences, and informal recommendations from the Yaskawa Partner Support team. It is meant to augment – not supersede manuals or documentation from motoman.com. Please contact the Partner Support team at [partnersupport@motoman.com](mailto:partnersupport@motoman.com) for updates or clarification.

## Tools: Yaskawa Cockpit

Yaskawa Cockpit uses a different approach than the other techniques mentioned here. Rather than a one-to-one relationship between a PC and a robot controller, Yaskawa Cockpit can be purchased to provide real time monitoring of *multiple* robots and devices in a location from one PC. The Cockpit PC also serves as a web server that can be accessed to view the status of your Yaskawa equipment on site and setup automatic notification via email.

Yaskawa Cockpit works with DX100, DX200, YRC1000 and YRC1000Micro controllers. In addition, it can also be used with our MP3200 and MP3300 motion controllers. The architecture allows for support of other devices via development of Add-on functions.

### Key Features

- Asset Management for understanding how your robots are performing. Are they meeting operational targets, and what is the status and health of the devices?
- Preventive Maintenance information that shows you when it is time to replace or inspect various components. This maximizes your uptime and performance and puts you in control.
- Alarm Forwarding will immediately notify the proper personnel should issues occur, enabling them to react quickly to mitigate any problems
- Data Management capabilities keep all this critical data in a centralized database, with routine backups to preserve the integrity of the operations
- Finally, Yaskawa Cockpit is extensible. This means that it can interface with external systems or the extended enterprise to share data and can also monitor non Yaskawa devices through a feature we call Add-on Functions.

The Yaskawa Cockpit software is installed on a PC Server at the same site as the equipment to be monitored. The installation includes software for communication with all the monitored components, a database to save and analyze the information that is gathered and a web server for others to manage and view the data. Anyone with a web browser that can access the Yaskawa cockpit PC can view and manage the data there.

The screenshot displays the Yaskawa Cockpit web interface. At the top, there is a navigation bar with 'YASKAWA Cockpit' logo, 'LINE GROUP', 'SETTINGS', 'LOGOUT', and a 'Welcome Administrator !!' message. Below this is a breadcrumb trail: 'Home > Yaskawa > TAT Lab > General Testing > 3D Vision DX200(Basic Info)'. A main menu contains five tabs: 'Basic Info', 'Status', 'Alarm & Log', 'Maintenance', and 'Backup'. The 'Basic Info' tab is active, showing a 3D model of a blue robot arm. To the right of the model are two tables: 'System Structure' and 'System Monitoring Time'. Below the model is a 'Controller Information' table, and to the right of that is a 'Version Information' table.

System Structure	
R1 :	MS210/MH225-A0*/MS210)

System Monitoring Time	
Control Power Time :	2018/11/15 14:39: 858:42'07
Servo Power Time :	2018/11/15 14:39: 509:15'38
Playback Time :	2018/11/15 14:39: 356:49'21
Moving Time :	2018/11/15 14:39: 11:58'19
Operating Time :	2018/11/15 14:39: 0:00'00
Accumulated Energy-Saving Time :	2018/11/15 14:39: 307:49'57

Controller Information	
Serial No.	0123456789
Controller Name	3D Vision DX200
Cell Name	General Testing
Line Name	TAT Lab

Version Information	
Application	GENERAL
System Software Version	DN2 45.00A(JP/US)-00
Language	ENGLISH / JAPANESE

Figure 8 - Yaskawa Cockpit

This document captures ideas, experiences, and informal recommendations from the Yaskawa Partner Support team. It is meant to augment – not supersede manuals or documentation from motoman.com. Please contact the Partner Support team at [partnersupport@motoman.com](mailto:partnersupport@motoman.com) for updates or clarification.

A complete description of the benefits and features of Yaskawa Cockpit would be well beyond what can be covered here. See the links below for more information.

## References – Yaskawa cockpit

<b>Controller</b>	<b>Manual Name / Link</b>
YRC1000, YRC1000micro. DX200, DX100	<a href="#">Yaskawa Cockpit (Web Page)</a>
YRC1000, YRC1000micro. DX200, DX100	<a href="#">Yaskawa Cockpit</a>
YRC1000, YRC1000micro. DX200, DX100	<a href="#">Getting Started with Yaskawa Cockpit</a>
YRC1000, YRC1000micro. DX200, DX100	<a href="#">Yaskawa Cockpit Maintenance Manual</a>
YRC1000, YRC1000micro. DX200, DX100	<a href="#">Yaskawa Cockpit Robot Data Change Point Notification Instructions</a>
YRC1000, YRC1000micro. DX200, DX100	<a href="#">Yaskawa Cockpit Torque Sensor Monitor Instructions</a>
YRC1000, YRC1000micro. DX200, DX100	<a href="#">Yaskawa Cockpit Software Programmer's Manual</a>
YRC1000, YRC1000micro. DX200, DX100	<a href="#">Yaskawa Cockpit Web API Reference</a>
YRC1000, YRC1000micro. DX200, DX100	<a href="#">Yaskawa Cockpit Software Development Manual</a>

This document captures ideas, experiences, and informal recommendations from the Yaskawa Partner Support team. It is meant to augment – not supersede manuals or documentation from motoman.com. Please contact the Partner Support team at [partnersupport@motoman.com](mailto:partnersupport@motoman.com) for updates or clarification.

## MotoSim

If you have our MotoSim software on a PC that is connected to a controller via Ethernet, you can use the “Online Function” of MotoSim. With the Online Function you can:

- Reconstruct a real system configuration in MotoSim
- Monitor the condition of a real controller
- Receive files from the controller and load in to MotoSim
- Save files from MotoSim and send them to the controller

The MotoSim online function requires the “High Speed Ethernet Server Function. This is not available on the NX100, and must be enabled on the DX100, DX200 and FS100. Additional information is available in the References section below.

## References – MotoSim

Controller	Manual Name / Link
YRC1000, YRC1000Micro, FS100, DX200, DX100, NX100	<a href="#">MotoSim Product Information</a>

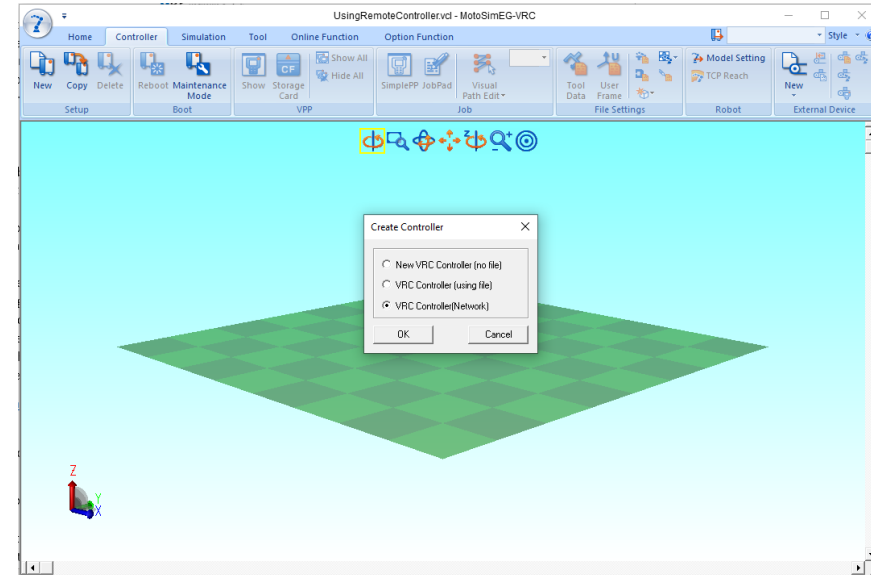


Figure 9 - MotoSim Online Function

This document captures ideas, experiences, and informal recommendations from the Yaskawa Partner Support team. It is meant to augment – not supersede manuals or documentation from motoman.com. Please contact the Partner Support team at [partnersupport@motoman.com](mailto:partnersupport@motoman.com) for updates or clarification.

## Tools: Developing Your Own

There are Yaskawa products and free reference materials to help you develop programs to communicate with our controllers over a network connection. This development requires expertise in software development, network protocols and sometimes advanced concepts for Motoman robots.

The “[Ethernet Function](#)” document describes low level protocol that can be used to develop programs that talk to the robot controller over Ethernet. (See section 3, High Speed Ethernet Server Function”.) There is no cost for this – it just documents the protocol used to talk with the controller. It works with all our systems that support Ethernet. Setup instructions are in section 2.

### References – High Speed Ethernet Server Function

Controller	Manual Name / Link
YRC1000	<a href="#">Ethernet Function</a>
YRC1000micro	<a href="#">Ethernet Function</a>
DX100	<a href="#">High-Speed Ethernet Server Function</a>
DX200	<a href="#">High-Speed Ethernet Server Function</a>
FS100	<a href="#">High Speed Ethernet Server Function</a>
NX100	<a href="#">Ethernet Server Function</a>

[The MOTOCOM SDK](#) is a purchased product that is used to make it easier to develop PC applications that use the above protocol. This eliminates a lot of the work of designing and coding interfaces to the network and controller. Still a fairly high level of programming and technical expertise is required.

### References – MotoCom SDK

Controller	Manual Name / Link
YRC1000, FS100, DX200, DX100, NX100, NXC100, XRC	<a href="#">MotoCom SDK Product Information</a>

This document captures ideas, experiences, and informal recommendations from the Yaskawa Partner Support team. It is meant to augment – not supersede manuals or documentation from motoman.com. Please contact the Partner Support team at [partnersupport@motoman.com](mailto:partnersupport@motoman.com) for updates or clarification.

[MLX300](#) is a different approach, allowing you to control the robot via a PLC. The PLC programming is done via a PC. This is a purchased option also. The PLC basically functions in place of the controller to move the arm, evaluate I/O, set variables, etc.

#### References – MLX300

Controller	Manual Name / Link
YRC1000 Material Handling robots (except HC10), YRC1000 micro robots (except HC10DT), DX200 material handling robots	<a href="#">MLX 300 Product Information</a>

[ROS](#) (specifically, *ROS-Industrial*) is an open source (free) environment for development of solutions in industrial automation. This has a steep learning curve but is extremely powerful. ROS currently runs on Linux PC's. ROS basically replaces the controller and can simultaneously interface to multiple robots from different vendors, camera systems, PLC's, etc. Yaskawa is a major contributor / supporter of ROS. [More detail is available here.](#)

This document captures ideas, experiences, and informal recommendations from the Yaskawa Partner Support team. It is meant to augment – not supersede manuals or documentation from motoman.com. Please contact the Partner Support team at [partnersupport@motoman.com](mailto:partnersupport@motoman.com) for updates or clarification.

## Connecting to your Robot Network from Other Locations

Up to this point, everything discussed has been in the context of connecting a local PC to a local robot controller. What if the requirement is to access the robot controller from a PC that is not at the same location as the controller? While network design, security, performance, and connectivity options are all best left to the experts, we know how our products operate on a network and have experience working with Yaskawa customers to enable remote access. There are some simple techniques that will allow you to connect to a robot in a different location without being directly wired to it.

### VPN Solutions

One method we have used to connect to a robot at another site is to use VPN (Virtual Private Network) solutions. Some companies may already have this technology in place, for people to work from home with their laptops and still connect to company servers. A Virtual Private Network solution creates a private network connection over the internet. For the remote (e.g. laptop) user, it appears that they are on the same network that exists in the other site, down to having the same IP addressing scheme. A diagram of a generic VPN solution is shown to the right.

Hardware or software must be in place at each site to create the VPN. Often, the VPN is implemented in special software installed on the PC and in the network routers when set up for company-wide use.

What if your company does not have a VPN? There are several third-party solutions that you can purchase to simplify the use of a VPN. Typically, they implement the solution as a hardware device, with two network connections: one connects to the Internet and one connects to the device that you want to be a part of the VPN. In an ideal world, the hardware is put in place at each site, the network connections are made, there is a bit of configuration to do in order to place them on the same VPN and everything works smoothly. However, we have found in our work with customers that some of these solutions work more smoothly than others. Be wary of solutions with extensive configuration options and be sure to thoroughly test with any products you may select. Look for a solution that allows all protocols to flow between devices without restrictions. Look for a solution that provides reliable connectivity and test for performance.

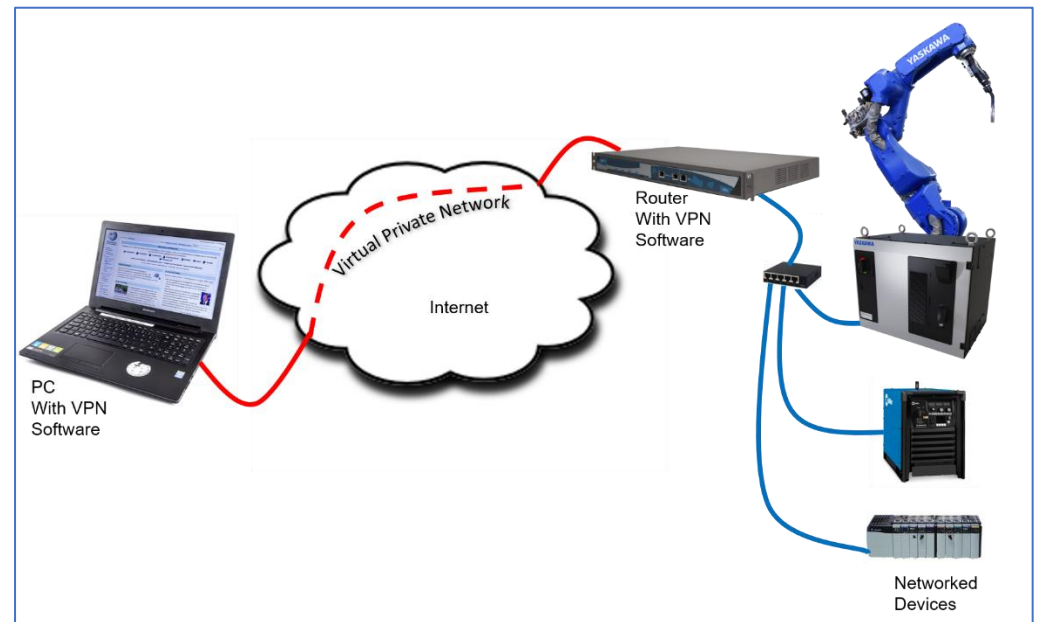


Figure 10 - Generic VPN diagram

This document captures ideas, experiences, and informal recommendations from the Yaskawa Partner Support team. It is meant to augment – not supersede manuals or documentation from motoman.com. Please contact the Partner Support team at [partnersupport@motoman.com](mailto:partnersupport@motoman.com) for updates or clarification.

## Axatrax Remote Connection Technology

One solution we have had success with is the [Axatrax VPN device from Axatronics](#). This solution is as simple as plugging the equipment in at both sites and completing some simple configuration steps. The product design allows connections between devices to be made and broken dynamically via a web page. This A company can deploy multiple Axatrax appliances and manage the “mesh” of connections between them as needed and shown to the right. This provides great flexibility to connect people temporarily and securely to equipment as needed. In addition, access to an Axatrax device can be temporarily “loaned” to another company with an Axatrax mesh.

With Axatrax, the “local” PC and the robot appear to be on the same network subnet. Everything works as if you are sitting right next to the robot. As a bonus, the local PC has access to everything on the robot subnet. PLC’s, welding power supplies, and other networked industrial equipment can be accessed also with proper logins and security.

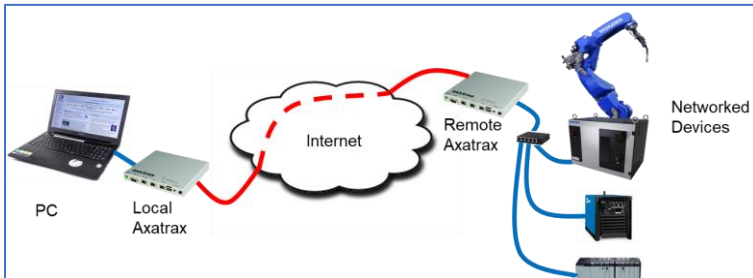


Figure 12 - Sample Axatrax configuration

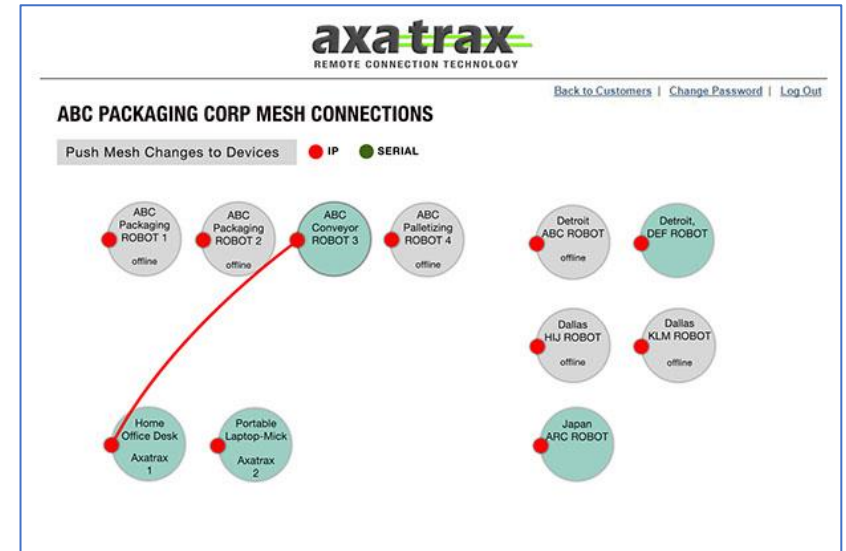


Figure 11 - Axatrax mesh configuration web page



This document captures ideas, experiences, and informal recommendations from the Yaskawa Partner Support team. It is meant to augment – not supersede manuals or documentation from [motoman.com](http://motoman.com). Please contact the Partner Support team at [partnersupport@motoman.com](mailto:partnersupport@motoman.com) for updates or clarification.

## Connecting Using PC's and Remote-Control Software

Another alternative that has been used successfully by our team is PC remote control software (such as TeamViewer, Microsoft Quick Assist, etc.) If you have a spare or inexpensive PC that can be left powered on and connected to the network near the robot and connected to the Internet, you have some more options. Some remote-control software (such as TeamViewer) allow for “Unattended Operation”, meaning a remote user can login and control that PC from another location without anyone approving access at the PC.

With this setup, a remote user can connect to the PC at the robot site and act as if they were using it locally. mouse and keyboard input are sent to the remote PC and screen changes are sent back. Any software installed on the remote PC (such as Robot Manager or Yaskawa cockpit) can be used.

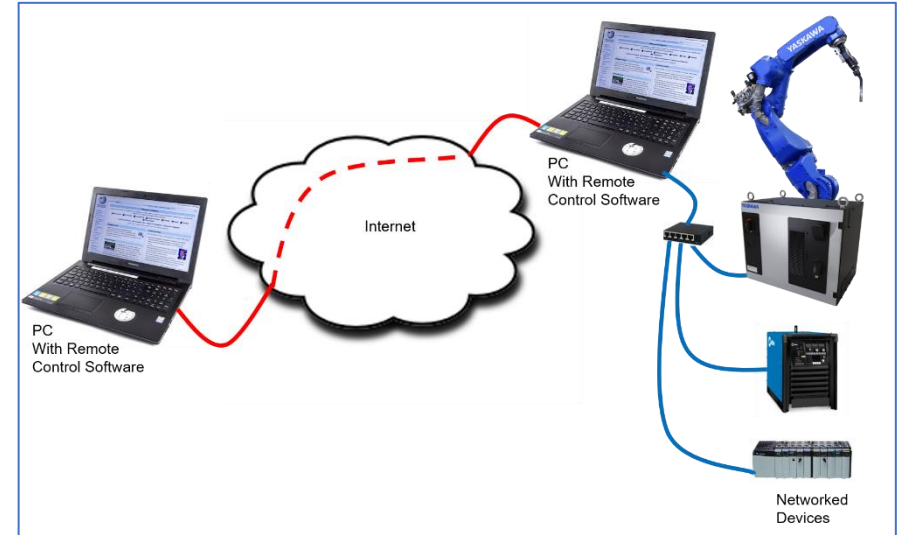


Figure 13 - access by PC remote control

## Conclusions

Networking your robots opens a world of opportunities to incorporate products and services from Yaskawa and third parties. See more information at [www.motoman.com](http://www.motoman.com) or the Yaskawa Partners Website at <http://yaskawapartners.com/>.