YASKAWA

Single Functions and Packages YRC1000

Controller YRC1000

Contents

A Global Company

YASKAWA is a company of people pursuing their passion. Driven by the vision of a smarter future with advanced technologies that save precious time and energy. And for us, any given day is a new chance to make progress.

Our goal is to contribute to the evolution of society by improving the nature of its business, increasing the performance and productivity of our industry, and therefore our everyday lives. Naturally we promote renewable resources to ensure a healthy environment – for a sustainable planet for all of us.

14,500
Employees
Worldwide

1,900
Employees
EMEA Region

8
European
Manufacturing
Locations

23
European Entities
Regional Presence

2.2 Million
AC Drives
Production 2018

27 Million
Accumulated Units
produced (as of 2018)

2.1 Million
Servo Drives
Production 2018

18 Million
Accumulated Units
produced (as of 2018)

48,000
Industrial Robots
Production in 2018

430,000
Accumulated Units
produced (as of 2018)

TOP 100

- Top 100
  Global Innovator
  2015, 2016,
  2017, 2018 *

- 100+ European
  Channel Partners

- Network
  of System
  Integrators

* Clarivate Analytics
(former part of Thomson Reuters)
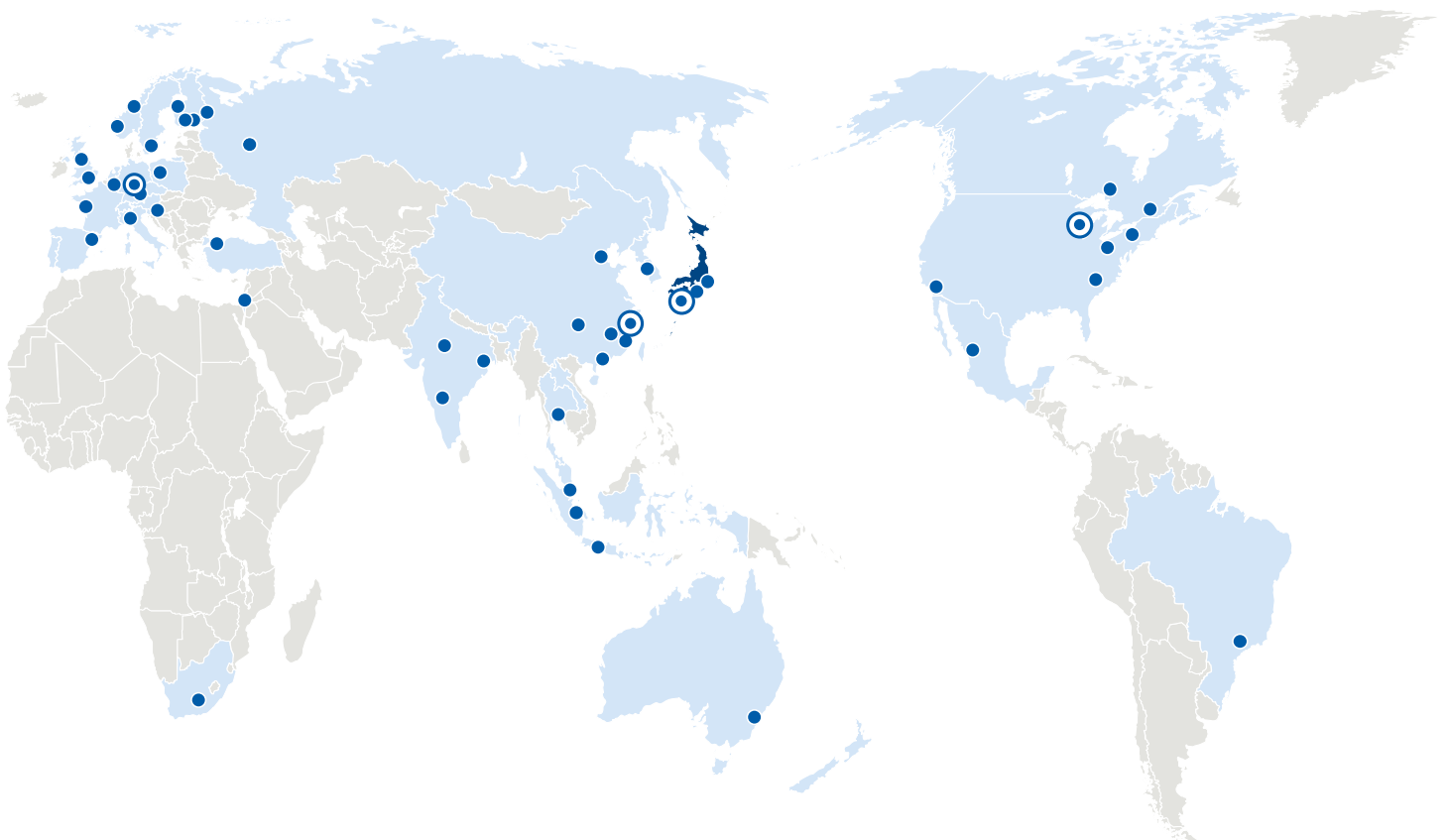
Expand the Horizon
of your Robot and your System!

MOTOMAN software offers user-friendly functions in a variety of
application fields and provides uncomplicated and efficient assistance
in every production phase.

Overview of Communication Functions

Robot

Controller

PP

PC
Software PP
MotoSim

HMI

SPS

Module
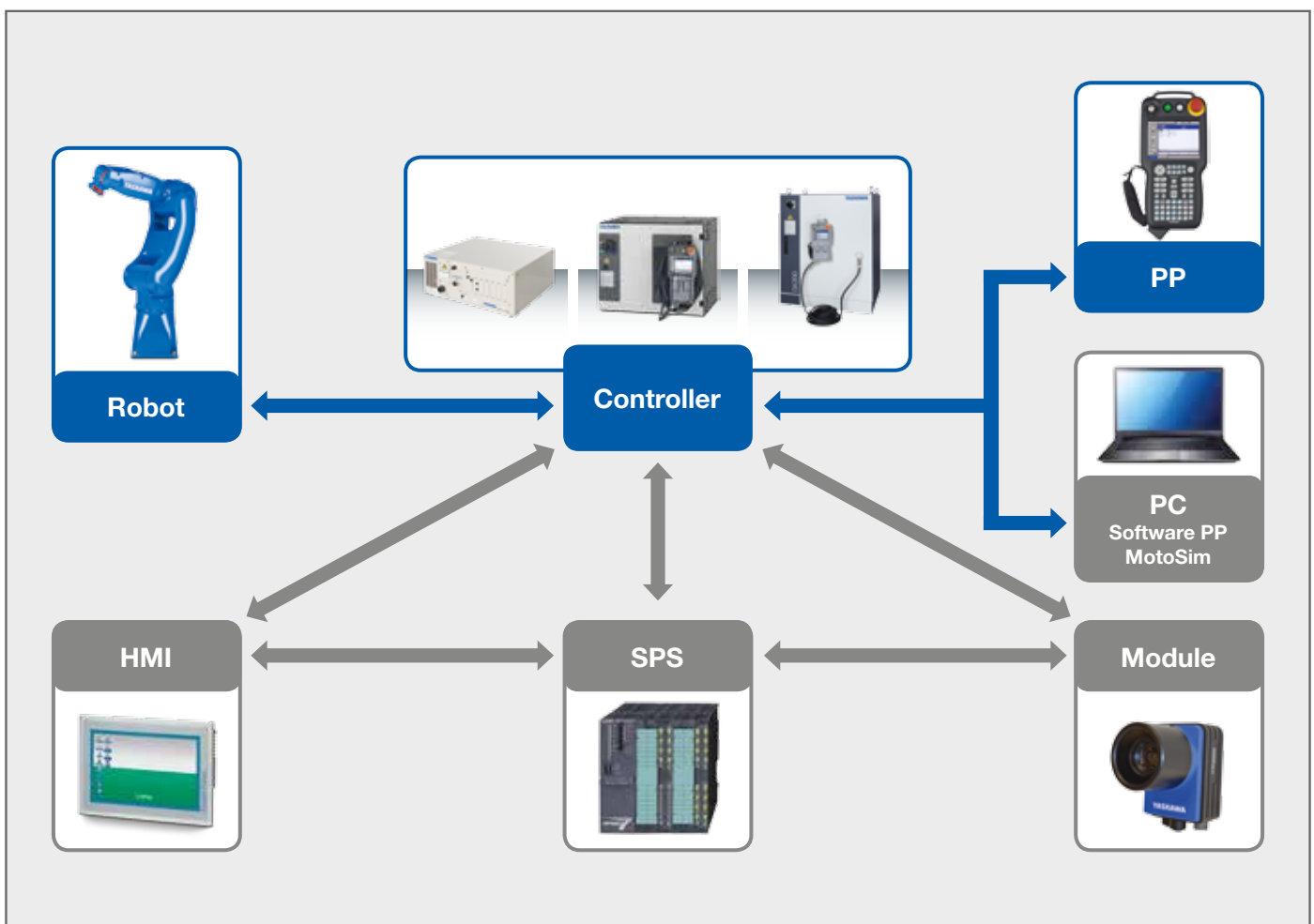
MOTOMAN robot controllers are open controllers. From the NX100 controller generation onwards, both the RS232 interface and the Ethernet interface have come as standard. Depending on the specific controller generation, many expansion cards are optionally available in addition to these interfaces, as both master and slave versions, for supporting industrial bus communication. Bus communication replaces conventional 24 V IO wiring. With some exceptions (e.g. MOTOMAN Sync), access is accordingly restricted to the IO level. While the bus interfaces are thus generally used for exchanging Boolean data values (On/Off), RS232 and Ethernet are used for exchanging higher-level data types (such as positions, status messages, etc.).

Standard interfaces RS232 and Ethernet

The standard interfaces RS232 and Ethernet initially describe the lower levels (refer to OSI-layer model) of a communication. The decisive factor for communication however is the application level, i. e. the protocols of the upper level. MOTOMAN controllers have a whole range of application protocols enabling communication with the outside world. These include standard protocols such as FTP and HTTP as well as YASKAWA-specific protocols BSC, Ethernet Server, High Speed Ethernet Server, etc. The available protocols can be grouped in client and server protocols. The client, as the communication master, initiates communication by sending queries to a server. The server returns the requested data. Between the queries the server is in standby mode.

Server protocols

Server protocols serve to retrieve data from the robot controller by means of an external device. These can be different data. For example, server protocols are used to connect HMIs. MOTOMAN controllers have the following server protocols:

FTP Server

The FTP protocol is a protocol for file transfer. In the case of MOTOMAN robots these can be program data (job files), system data (tool data, conditional files, etc.) or parameter data.

BSC Server (Host mode)

The BSC protocol is the earliest YASKAWA communication protocol. The advantage of this is that the protocol has been continuously supported by all controller generations since ERC. This guarantees investment security since created applications can be transferred to other controller generations with no or only minor modifications. The BSC Server protocol is a "General Purpose" protocol. It offers functions for access to variables, IO signals, files, motions, alarms, etc. The protocol supports Ethernet and RS232. Only the RS232 variant (Data Transmission Function) is open. The MotoCom SDK however is an implementation in the form of a Windows Functional Library (DLL).

Ethernet Server

The Ethernet Server protocol is an improvement of the BSC protocol in terms of performance and Multiclient support. The functionality is identical to that of the BSC Server protocol. The protocol exclusively supports the Ethernet interface. It is open and also finds an implementation MotoCom SDK. Only there is also a high compatibility with the BSC protocol. In most cases, earlier BSC-based MotoCom applications can therefore be quickly incorporated in Ethernet server-based applications.

High Speed Ethernet Server

The High Speed Ethernet Server protocol is the current "General Purpose" protocol of the MOTOMAN robot controllers. Compared with the Ethernet Server protocol, performance and functionality are improved. The High Speed Ethernet Server protocol is the standard protocol of the controller types DX100, DX200 and FS100 and future generations.

A simple application of the protocol can also be achieved here using MotoCom SDK.

MotoLogix

MotoLogix represents a software and hardware interface that enables users to control and program the robot through PLC and offers an innovative approach for a control of all-axis coordinated robot motion, similarly to traditional robot controller.

The difference between PLC controlled robot and conventional robot control is that PLC issues the motion commands for the robot, while the robot controller performs calculations of motion kinematics. The YRC1000 robot controller is reduced to the role of a motion controller and the actual program execution and the definition of the motion are carried out by the PLC. This therefore eliminates the need to learn the robot language and allows the programmer to use the PLC language he already knows.

Client protocols

Client protocols serve to retrieve data from an external device. A frequent example of the robot as a client is e.g. the communication with vision systems.

FTP Client

In addition to the FTP Server function, MOTOMAN controllers also have FTP Client function. It cooperates with common FTP servers (IIS, Filezilla, etc.). The FTP protocol is a special favourite of system administrators since it is an internet standard protocol with a wide range of experiences and tools.

BSC Client (DCI mode)

In the Client mode of the BSC protocol only variables and files can be transferred. This is done in the course of a job (Data Communication by Instruction). This means that the transfer is started by a corresponding instruction (e. g. LOADJ) and carried out synchronously with execution of the program. One application example is the dynamic reloading during program transfers to PCs. Corresponding server components can be created by the user on the basis of MotoCom SDK or purchased (see MotoDCI). The properties of the protocol correspond to those of the server variant.

Vision interface

VSTART is an inform instruction. Inform is the programming language of the MOTOMAN controllers. It maps the vision interface of the MOTOMAN robot controllers. It maps the communication protocols of a variety of selected vision systems and works, dependent on these, on the basis of Ethernet or RS232. Compatible cameras are systems from Cognex (Insight Native Mode), Keyence and Omron to name but a few. In practice, this instruction is used to trigger the image recording within job application programs and to transfer the position data.

Socket communication

Socket communication refers to the communication using arbitrary sockets on the basis of user-defined protocols. Unlike the above mentioned permanently defined protocols, this allows for free communication on TCP/IP Ethernet (or RS232). This enables the connection of any kind of device (vision systems, sensors, etc.)

The robot can optionally act as client as well as server. MOTOMAN robot controllers allow socket communication via MotoPlus technology. From the user's point of view, the protocols can either be implemented in the form of a MotoPlus application or a MotoGSI application. Beyond this, the corresponding SDKs (Software Development Kits) are available (see MotoPlus SDK or MotoGSI SDK). In the case of MotoGSI, implementation is carried out on the job level in the programming language Inform. In the case of MotoPlus, on the other hand, in the high-level programming language C using a PC-based development environment (MotoPlus IDE in the package of MotoPlus SDK).

Overview of Single Functions and Packages

PalletSolver	MotoLogix	MotoFit	General Application / Euromap 67	ARC Welding	HC-series

Standard Setting

Standard Setting Expanded

PalletSolver	MotoLogix	General Advanced	General Advanced	Welding Power Source	HC
		MotoFit		Comarc	HC-DT
				Comarc & Multilayer	
				ARC-TCP Control	
				Range Limits for Robots*	

Multirobot Station

Individual STO

Functional Safety

Safety Bus	Ethernet Save

Options PC-Software

External Axes Cabinet

Options Robot

Options External Axis

Options Vision

Options Customization

Options App

☐ = Packages

☐ = Single functions

*   Depending on the robot model and welding package manufacturer, the range of movement of the robot hand axes is limited.

Standard Settings

**Standard Setting
SAP: 181519**

SAP	Function
181449	Relative Job
181453	Independent Control
181454	Coordinated Motion
181464	Welding in Teach Mode
181466	Macro Command
181470	Structured Language
181471	Logging Function
181472	Job Editing during Play
181473	External IO Allocation
181477	Alarm Details Displaying
181479	CMOS Save with FTP
181483	Configuration Parameter
181489	Ethernet Standard
181513	MotoPlus Runtime

**Standard Setting Expanded
SAP: 181520**

SAP	Function
181450	External Reference Point
181452	System Job*
181457	Interrupt Job
181458	TCP
181475	Ladder Editor
181487	Tag Data Replace

* available from software version 2.44.00

MotoLogix

	SAP	Function
Appl. MotoLogix **SAP: 181530**	181481	IO Output Timing Control
	181488	MotoLogix
	181494	Feedback Position based PL (FPL)

PalletSolver

Appl. PalletSolver
SAP: 197829

General

	SAP	Function
General Advanced **SAP: 181521**	181455	Search Function – Soft Stop
	181461	Teaching Point Adjustment
	181462	Point Variable (T-Variable)
	181465	Shift Condition Cancel
	181467	Search Continuous Motion
	181469	Interface Panel (IF Panel)
	181484	Numerical Input Screen Display with Direct Open
	181485	Weaving Adjustment

HC-series

	SAP	Function
HC-series **SAP: 181535**	181474	Password Protection
	181495	FSU
	181511	PP Custimization Runtime
HC-DT-series **SAP: 197838**	191520	Standard Safety Expanded
	181521	General Advanced
	182777	HC-Basic

MotoFit

	SAP	Function
Appl. MotoFit **SAP: 181538**	181511	PP Customization
	182771	MotoFit Basic

Functional Safety

Functional Safety
Functional Safety **SAP: 181495**

Functional Safety Single and Multi

Not supported by FSU

SAP	Function
181456	PMT*
181496	Speed Control
181498	IO Speed Control
182767	Multi Encoder

* without restrictions and support for system software 2.80.00-00

With restrictions

SAP	Function
181451	T-Axis Endless
181459	Link Servo Float
181460	Link and Linear Servo Float
181489	Ethernet Standard
181519	Standard Setting
181491	External Axis Endless
181493	Group Change
181500	Full-Speed Test
181502	Zeroing
181511	PP Customization Runtime
181512	Advanced PP Customization Runtime
181513	MotoPlus Runtime implement in
181518	MotoModbus
181528	MotoSight2D Oberfläche
181529	MotoGSI
181532	MS Camera
181536	Zimmer Gripper
182762	ROS-I
197829	PalletSolver
182769	Conveyor Standard
182770	Conveyor Synchronized with Shift
182771	MotoFit Basic
182773	Link and Linear Servo Float Multi Robot
182774	Link Servo Float Multi Robot
182775	Twin Drive
197881	Euler Angle implement in
197831	Multilayer
197883	Comarc implement in
197830	Comarc
197834	Comarc Multilayer

Individual STO

Individual STO
Individual STO **SAP: 182765**

Arc Welding

ARC-Weld Basic SAP: 197832

Is always included in the Power Source Packages.

SAP	Function
181452	System Job
181461	Teaching Point Adjustment
181465	Shift Condition Cancel
181468	Search – Hard Stop
181485	Weaving Adjustment
197884	Hover Weaving

Comarc SAP: 197830

SAP	Function
197883	Comarc Basic

Comarc + Multilayer SAP: 197834

Comarc SAP: 197830

SAP	Function
197883	Comarc Basic

Multilayer SAP: 197831

SAP	Function
181462	Point Variable
197880	Memo Play
197881	Euler Angle
197882	Special Shift

Welding Power Source (Interface)

Arc Digital*
SAP: 197840

Arc Analog*
SAP: 197841

Special ARC Analog
SAP: 197839

SAP	Function
197888	Grafical arc monitoring
197887	Welding conditioning guide

Arc Weldcom II Fronius*
SAP: 197842

Only for TPSi

ARC SKS Serial*/**
SAP: 197859

Only for serial communication (RS232)

Included Synchroweld function and RWDE Montitor.
Restrictions Synchroweld:
– Multirobot-system with station twin/triple/quadro and Synchro Motion can not be used together
  with Synchroweld function

ARC-SKS FB5*/**
SAP: 197844

Only for following bus-systems:
– Profibus DP   – Interbus-S Cu   – Interbus-S Fo   – DeviceNet   – Ethernet / IP   – ProfiNet IRT Cu

Included Synchroweld function and RWDE Montitor.
Restrictions Synchroweld:
– Multirobot-system with station twin/triple/quadro and Synchro Motion can not be used together
  with Synchroweld function

ARC Fronius TPSi-BUS*/**
SAP: 197843

Only for TPSi (MIG/MAG) and following bus-systems:
– ProfiNet   – Profibus   – DevicNet

ARC-ESAB_V8-2 BUS*/**
SAP: 197848

Only for MIG/MAG/TIG and following bus-systems:
– FB-DeviceNet   – Profibus   – ProfiNet   – EtherCat   – Ethernet / IP

ARC-Kemppi_A7 BUS*/**
SAP: 197849

Only for MIG/MAG and following bus-systems:
– FB-DeviceNet   – Profibus   – ProfiNet   – EtherCat   – Ethernet / IP

ARC-Lincoln Ethernet*/**
SAP 197853

Only for MIG/MAG and following bus-systems:
– Ethernet / IP   (Please notice: Only one MotoPlus function possible)

*   ARC-Weld Basic 197832 is included in Power Source Package   ** Includes IF-Panel

Options

Options Robot

SAP	Function
181451	T-Axis Endless
181452	System Job
181455	Search-Soft Stop
181456	PMT
181459	Link Servo Float
181460	Link and Linear Servo Float
181468	Search Function – Hard Stop
181469	Interface Panel (IF Panel)
181474	Password Protection
181478	Arm Interference with Specified Cubic Area Check
181480	Pendant Oscilloscope
181481	IO Output Timing Control
181482	Safety Re-teach
181492	General Sensor Function
181494	Feedback Position based PL (FPL)
181496	Speed Control
181497	Macro Name with up to 16 Characters
181500	Full-Speed Test
181502	Zeroing
181508	Ethernet IP-CPU Board
182763	TSYNC Monitor
182766	Arm Interference Check (Only for Multi Robot)
182768	Master Tool User Frame
182769	Standard (Conveyor Synchronized)
182770	Conveyor Synchronized with Shift
182773	Link Servo Float Multi Robot
182774	Link and Linear Servo Float Multi Robot
182776	Advanced Control Group
197879	RIN 5+6 Extension
197915	Form Cut
203615	Self Interference Check

Options External Axis

SAP	Function
181463	IO JOG Operation in Play-mode
181491	External Axis Endless
181493	Group Change
181496	Speed Control
181498	IO Speed Control
181502	Zeroing
182768	Master Tool User Frame
182775	Twin Drive

Options

Options PC Software

SAP	Function
	Please see YASKAWA software brochure

Options Customization

SAP	Function
181511	PP Customization Runtime
181512	Advanced PP Customization Runtime

Options Vision

SAP	Function packages
181515	Vision Function
181528	MotoSight 2D interface for MS Camera
181532	MotoSight 2D Interface

SAP	Function
181532	MotoSight2D Interface
181456	PMT
181511	PP Customization Runtime
181516	MotoSight2D Basic

Options APP

MotoGSI
SAP: 181529

SAP	Function
181511	PP Customization Runtime
181517	MotoGSI Basic

MotoModbus
SAP: 181518

ROS-I and MOTOMAN
SAP: 182762

Zimmer Gripper Interface
SAP: 181536

SAP	Function
181511	PP Customization Runtime
182779	Zimmer Gripper Basic

Masters of Robotics, Motion and Control

Relative Job (181449)
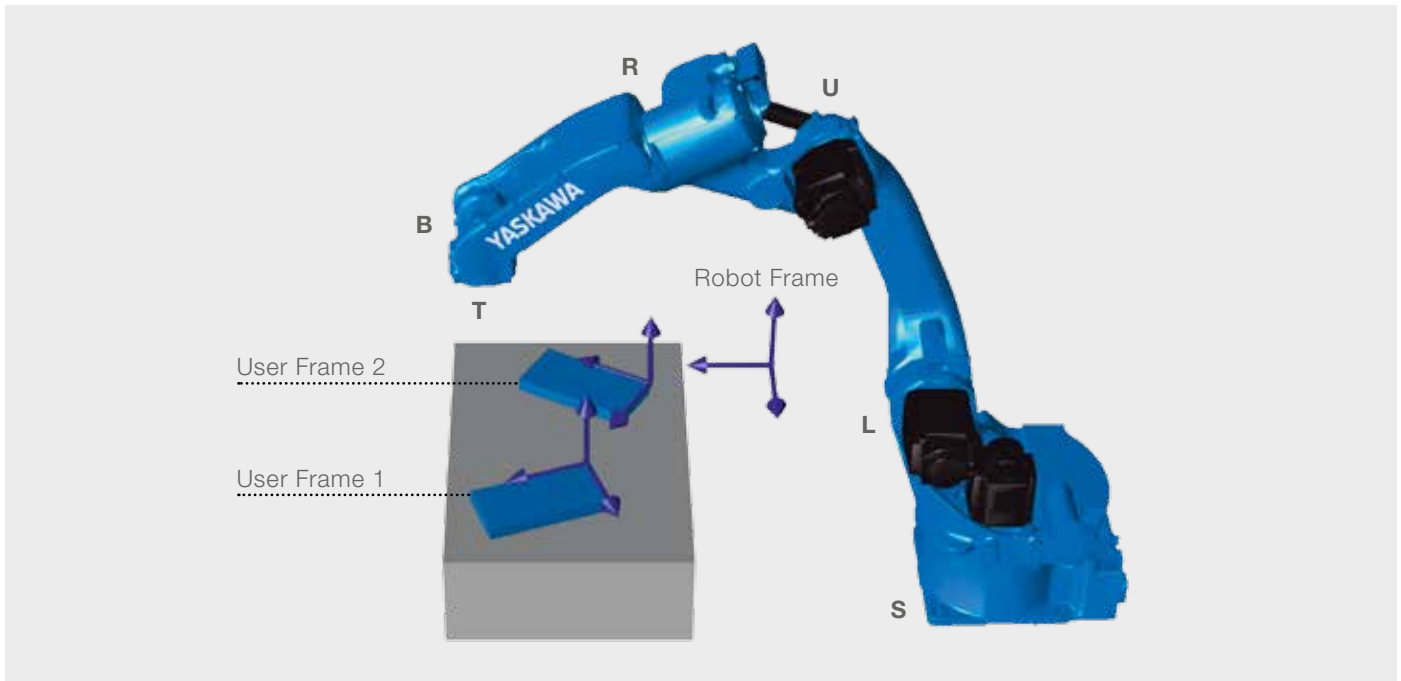
The robot usually stores position data for the operation in the form of pulse-type data (motor rotation pulse amount of each axis). The job (program) consisting of the pulse-type data is called "Standard Job". In contrast to the standard job, the program consisting of position data in the direction of X, Y, and Z, in reference to the origin in a coordinate system (such as base coordinate and user coordinate) is called "Relative Job". Converting the standard job creates the "Relative Job".

Although movement of the "Relative Job" itself is no different from the standard job, the "Relative Job" has a useful function called "Relative Job Shift" to shift the same movement in another. In the "Relative Job" in the user coordinate system, when a user coordinate is created by changing defined points, the movement shifted to the changed coordinate can be performed in the execution of the instruction.
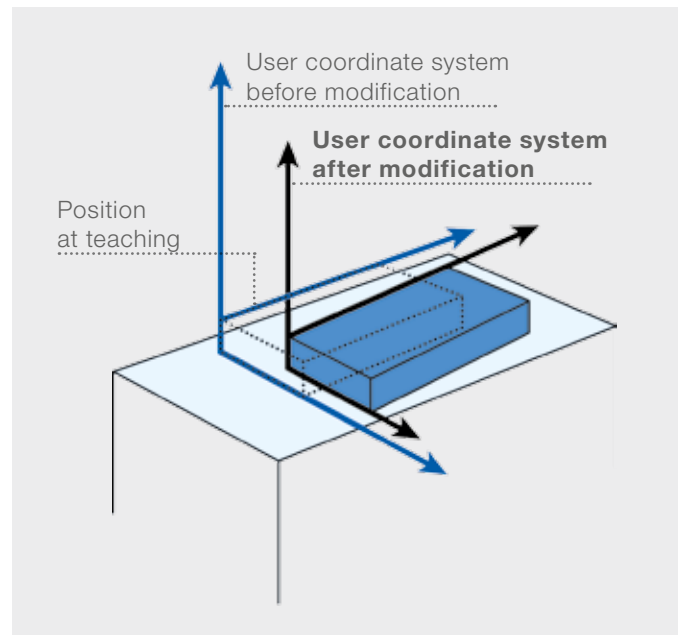
KEY BENEFITS

• Change a pulse-type Job to a coordinatedtype Job
• All points are stored in X, Y, Z
• With "Relative Job Shift" function, complete jobs can be shifted in different frames

Coordinated Motion (181454)

Jigless system

Coordinated positioner system

Twin synchronous system
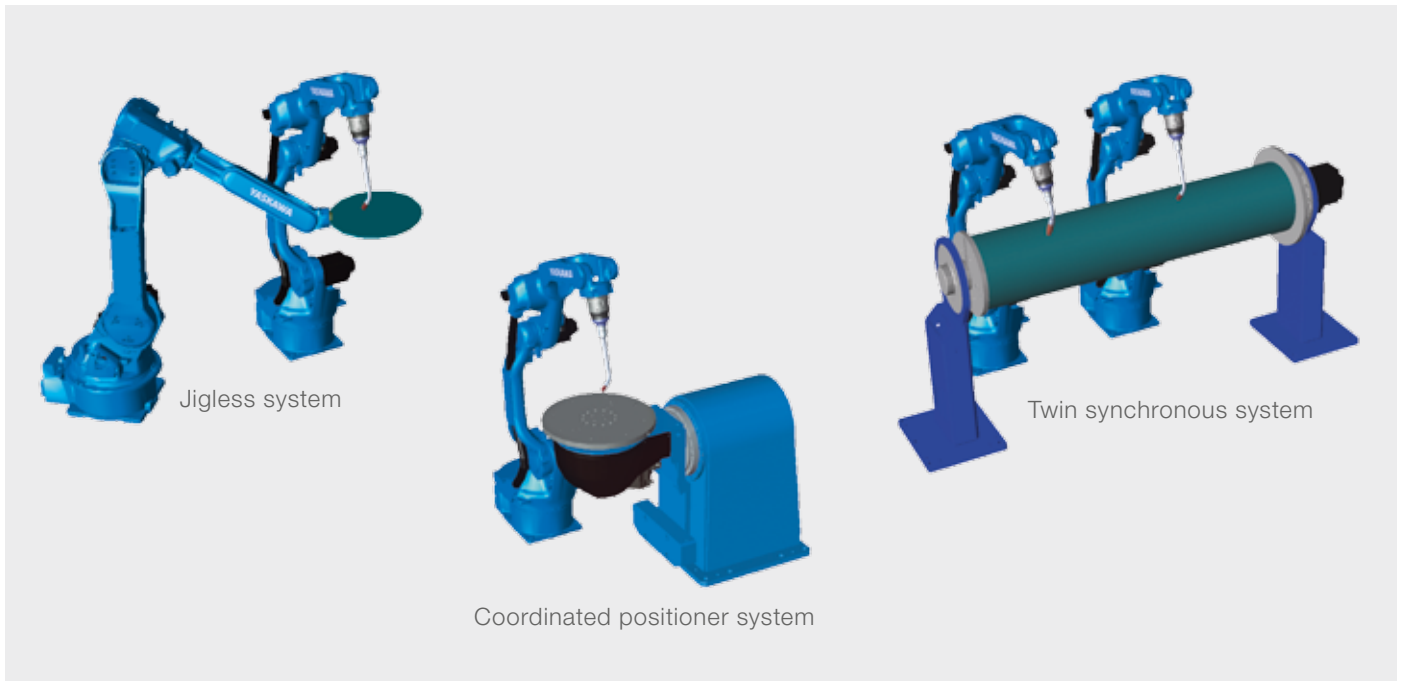
The "Coordinated Motion" function enables the station to hold the work piece and the robot has the working tool, and both of them work cooperatively.

The "jigless system" enables the first robot to hold the work piece and a second robot has the torch, and both of them work cooperatively. (The concept is the same as the station coordinated.)

To operate the station and robot or two robots at the same time, the coordinated job must be taught. Coordinated job is available in the coordinated interpolation that performs the relative interpolation with the station and robot related to master and slave, respectively, and in the individual interpolation that performs individual operation.

KEY BENEFITS

- Robot and station work cooperatively
- 2 robots work cooperatively
- Jigless welding of two robots

Welding in Teach Mode (181464)
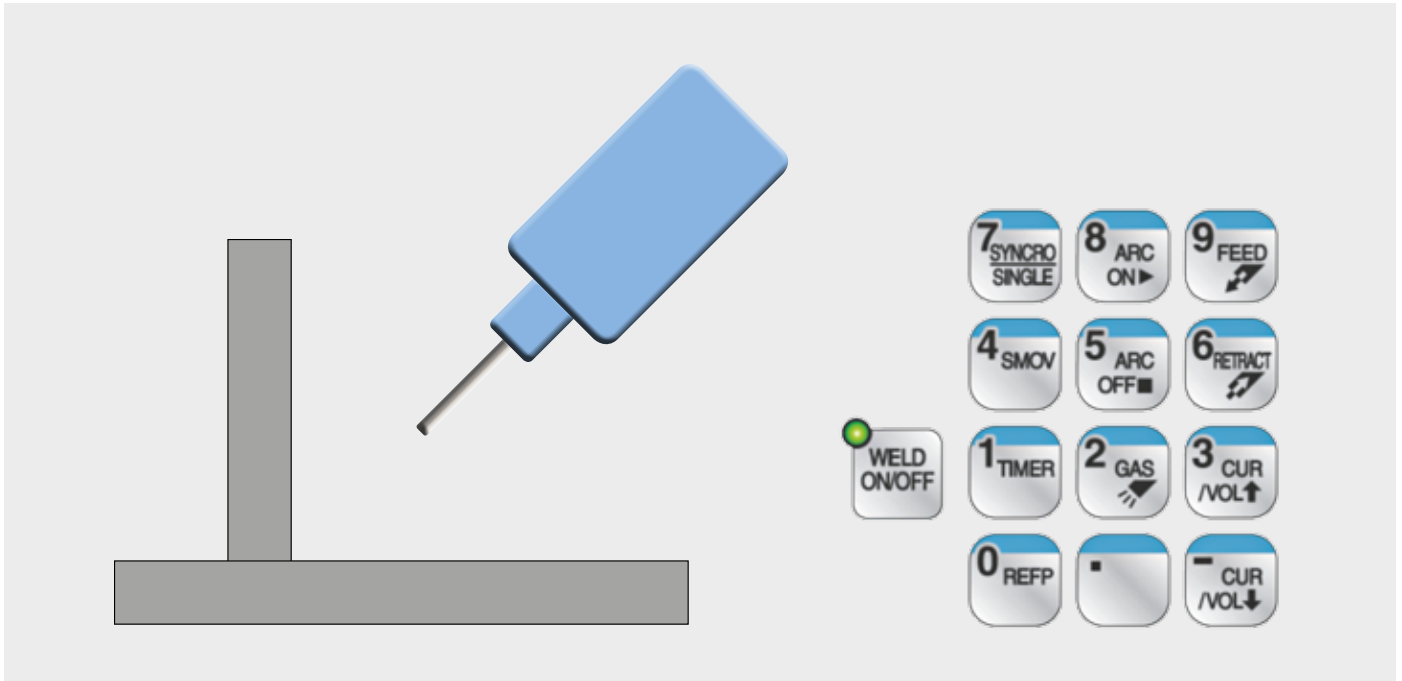
This function enables execution of ARCON/ARCOF instruc-tions not only during automatic mode but also in teach mode.

Welding conditions can be checked directly during program-ming.

Changing to automatic mode isn't necessary.

Activating by one-button-push on special application button of programming pendant.

KEY BENEFITS

- Check welding conditions and results immediately during programming
- No need to change to automatic mode
- Status information by optical and acoustical signal avoids mistakenly use
- Test run function can be executed as usual

Macro Command (181466)

<table>
<tr>
<td>

Example of macro instruction registry: SEALON

Line Step

000   NOP

001   MOVJ VJ 100.0

002   WAIT IN#(1) ON

003   MOVJ VJ 50.0

004   SEALON WIDTH=8

005   MOVL V=125

006   MOVL V=95

</td>
<td>

Example of macro job registry: SEALON

Line Step

000   NOP

001   GETARG LI000 IARG#(1) : Store 1st argument data '8' to LI000.

002   DOUT OT#(10) ON   : Turn ON general output 10.

003   MUL LI000 10   : Multiply the number of LI000 by 10. 8×10 80

004   WAIT N#(10) ON   : Wait for general input 10 to be ON.

005   AOUT AO#(1) LI000   : Output '80' to the analog output 1.

006   END

</td>
</tr>
</table>

"Macro Instruction" is the function for creating, registering, and executing one instruction from plural INFORM, that corresponds to each system.

An argument tag can be added to a macro command like a normal instruction. "Macro Commands" and their argument tags can be easily programmed at will in the job data display. Instruction creation procedure: Create a macro job (in normal teaching method) and register the macro job as a macro instruction. (In the macro instruction setting screen.)

Instruction to obtain argument for macro instruction (GETARG): When the macro instruction is executed, argument data added to the macro instruction is obtained and stored into the specified local variable to use the data in the macro job.

If a post-processing is required when a macro command is interrupted, it is possible to add an interruption macro job (SUSPEND JOB) to the program.

The interruption macro job is carried out when a macro command that includes the interruption macro job is interrupted by being putting on a status such as hold, emergency stop, or mode switching.

For macro job, executive commands such as "JUMP", "CALL", and "PSTART" cannot be registered. For interruption macro job, additionally TIMER instruction and WAIT instruction.

KEY BENEFITS

• Creating own functions and routines in INFORM list

Macro Name
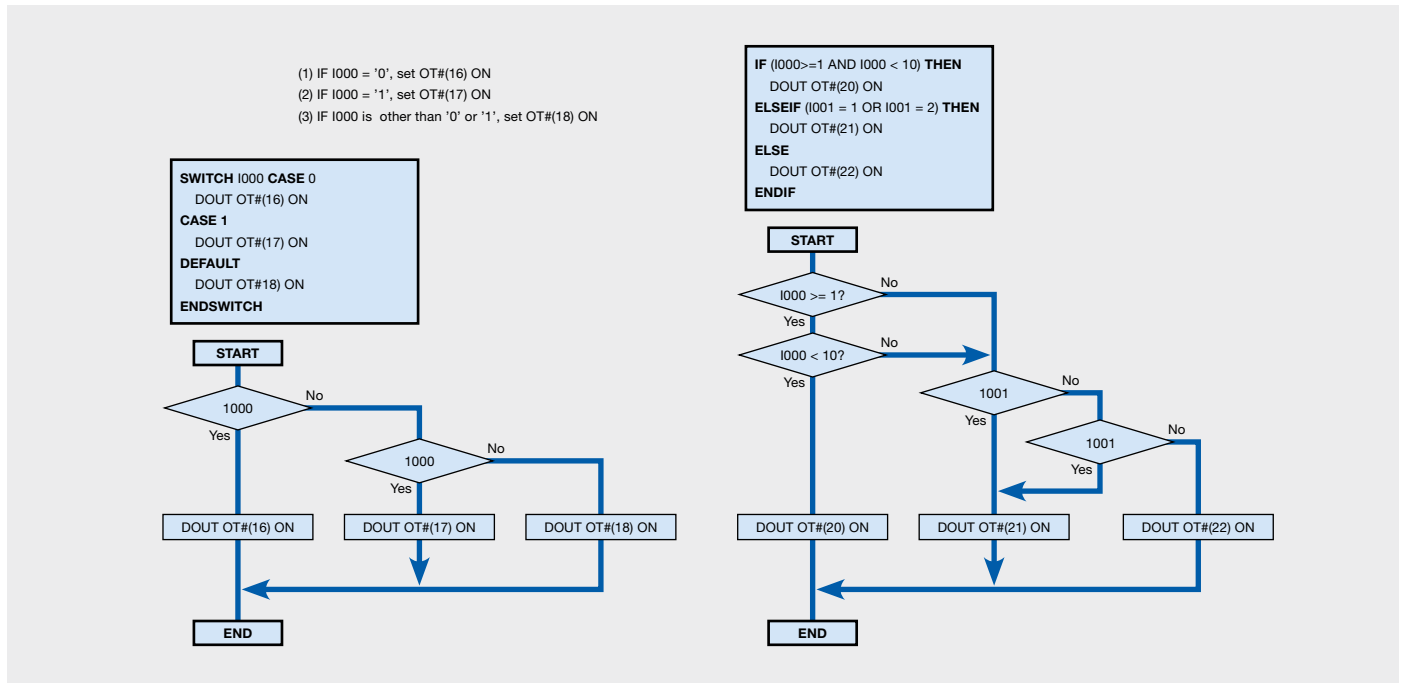# with up to 16 Characters (181497)
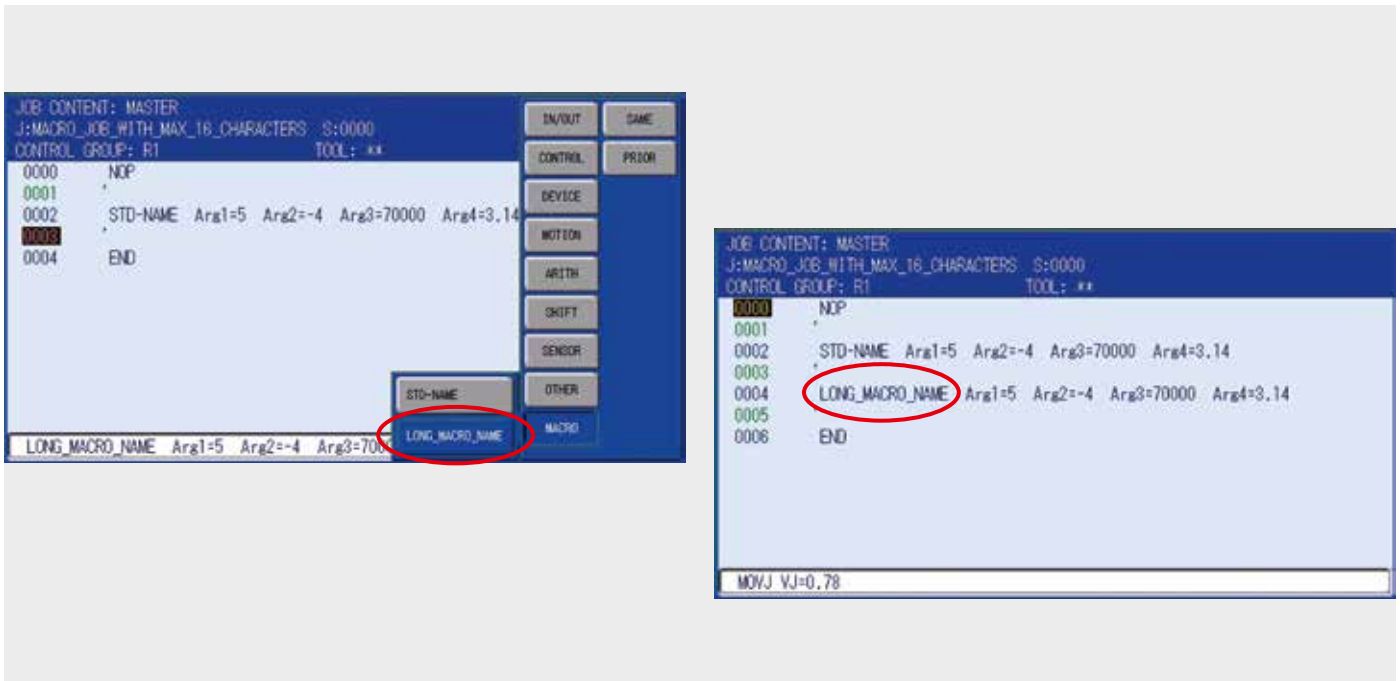
The "Standard Macro" function can use maximum 8 charac-
ters for the macro name. Often names have to be shortened,
what makes them difficult to read.

This function is an Add-On for "Macro" function and expands
the number of characters to a maximum of 16.

KEY BENEFITS

• Simple naming for macro jobs
• Better readability of program lines with macro

Structured Language **(181470)**

```
(1) IF I000 = '0', set OT#(16) ON
(2) IF I000 = '1', set OT#(17) ON
(3) IF I000 is  other than '0' or '1', set OT#(18) ON
```

```
SWITCH I000 CASE 0
    DOUT OT#(16) ON
CASE 1
    DOUT OT#(17) ON
DEFAULT
    DOUT OT#18) ON
ENDSWITCH
```

```
IF (I000>=1 AND I000 < 10) THEN
    DOUT OT#(20) ON
ELSEIF (I001 = 1 OR I001 = 2) THEN
    DOUT OT#(21) ON
ELSE
    DOUT OT#(22) ON
ENDIF
```

With the "Structured Language" function it is possible to create
clearly arranged programms based on high level language with the folloing instructions:

- IFTHEN-ELSEIF-ELSE-ENDIF
- WHILE-ENDWHILE
- FOR-NEXT
- SWITCH-CASE-ENDSWITCH

KEY BENEFITS

- Shorten programs
- Structured program overview
- Complex functionality, easy to implement

Logging Function (181471)

Log list

Log detail
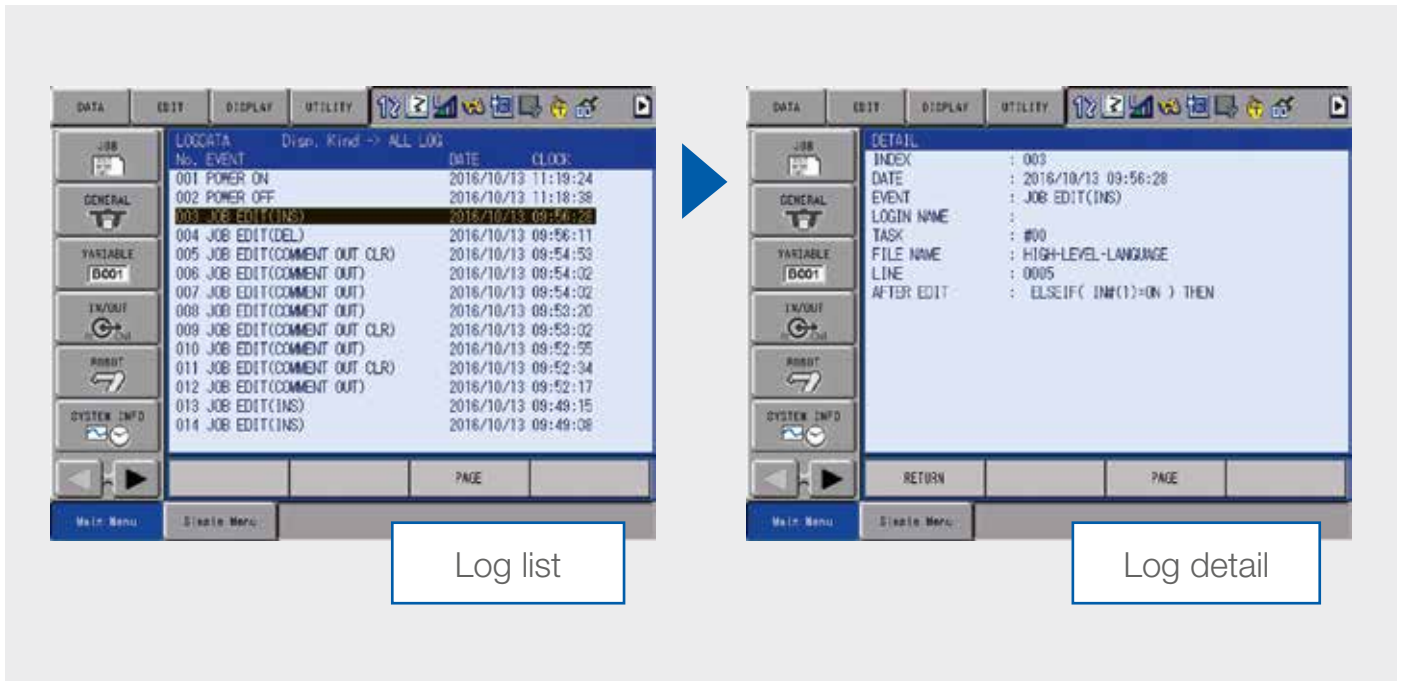
This function stores and displays the edit such as editing data of the robot controller program (job) and welding condition and the history (log) of programming pendant operation such as job execution.

This function also facilitates troubleshooting by ensuring the data traceability.

Stores 200 Data edit files (job concurrent IO ladder, various condition files, edit of parameters, variables and others).
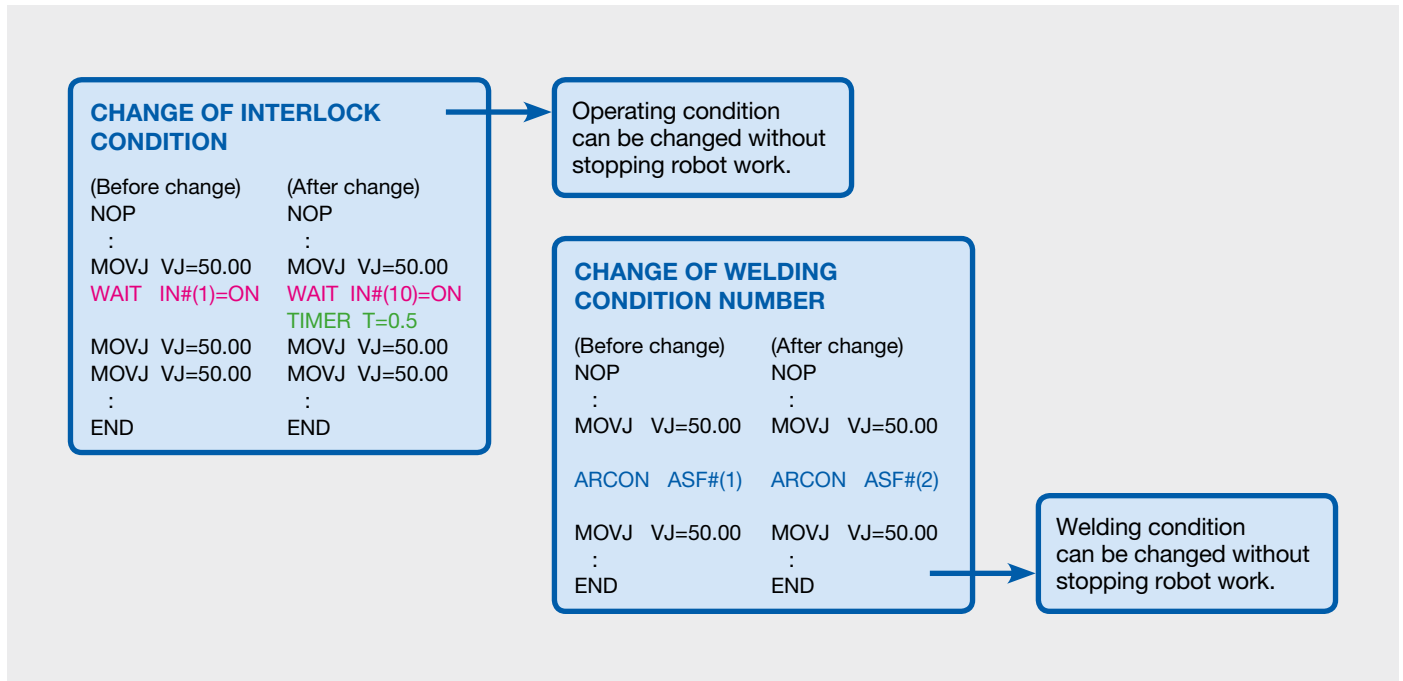
Stores 200 Pendant operations (job start, hold, emergency stop external memory load and save, and others).

It is also possible to extract and display only the log of data edit or pendant operation

KEY BENEFITS

- History of programming pendant operation can be checked
- Easy error diagnostic

Job Editing during Play (181472)

CHANGE OF INTERLOCK CONDITION

(Before change)	(After change)
NOP	NOP
:	:
MOVJ VJ=50.00	MOVJ VJ=50.00
WAIT IN#(1)=ON	WAIT IN#(10)=ON
	TIMER T=0.5
MOVJ VJ=50.00	MOVJ VJ=50.00
MOVJ VJ=50.00	MOVJ VJ=50.00
:	:
END	END

Operating condition can be changed without stopping robot work.

CHANGE OF WELDING CONDITION NUMBER

(Before change)	(After change)
NOP	NOP
:	:
MOVJ VJ=50.00	MOVJ VJ=50.00
ARCON ASF#(1)	ARCON ASF#(2)
MOVJ VJ=50.00	MOVJ VJ=50.00
:	:
END	END

Welding condition can be changed without stopping robot work.

Even when the line is in operation, "Job Editing" is possible.

A job can be edited even when the robot is producing or line is in operation, fine adjustment such as changing signal numbers, operating conditions and work conditions without stopping robot work.

KEY BENEFITS

• Cycle time can be reduced
• Operating conditions can be changed without stopping during his working time

External IO Allocation (181473)


```
EXTERNAL IO ALLOCATION(INPUT)
        ST#  CH  MAC ID  ADDR  BYTE  NAME
#20010   14   0    0      0     5   YIU01
#20060   16   0   254     0     1   DN3-PCU-1
#20070   16   0    1      1     5   DN3-PCU-1
#20120   16   0    2      6     4   DN3-PCU-1
#20160   16   0    3     10     3   DN3-PCU-1
#20190   17   0   254     0     1   CCS-PCU
#20200   17   0    0      1     6   CCS-PCU
```

IO mapping for each IO- or fieldbus board possible:

#20010 #20020 #20030 #20040 #20050	**JZNC-YIU01**	**IN data (YIU01)**	
#20060 #20070 #20080 #20090 #20100 #20110 #20120 #20130 #20140 #20150 #20160 #20170 #20180 #20190	**SST-DN3-PCU** (DeviceNet master)	Status of DeviceNet board	
		IN data (For DeviceNet slave1)	
		IN data (For DeviceNet slave2)	
		IN data (For DeviceNet slave3)	
#20200 #20210 #20220 #20230 #20240 #20250	**SST-CCS-PCU** (occupy two stations)	Status of CC-Link board	
		IN data (CC-Link)	

IN data (For DeviceNet slave1)

IN data (For DeviceNet slave2)

IN data (For DeviceNet slave3)

IN data (CC-Link)

IN-Daten (YIU01)
Status of DeviceNet board

Status of DeviceNet board

Status of CC-Link board

#20010 #20020 #20030 #20040 #20050 #20060 #20070 #20080 #20090 #20100 #20110 #20120 #20130 #20140 #20150 #20160 #20170 #20180 #20190 #20200 #20210 #20220 #20230 #20240 #20250

Status immediately after execution of automatic allocation

Status after execution of manual allocation

KEY BENEFITS

- IO area for each IO board or fieldbus (ProfiNet, DeviceNet etc) can be customized
- Easy to create standard IO interface depending on application or customer requests

Alarm Detail Displaying (181477)

Page   Alarm No.   Alarm explanation

} Alarm title
Same as alarm window data
(Ordinary window)

Alarm content

[Right/Left] button

Cause

Possible solution

[Return]   [Reset]   [Page]
button   button   button
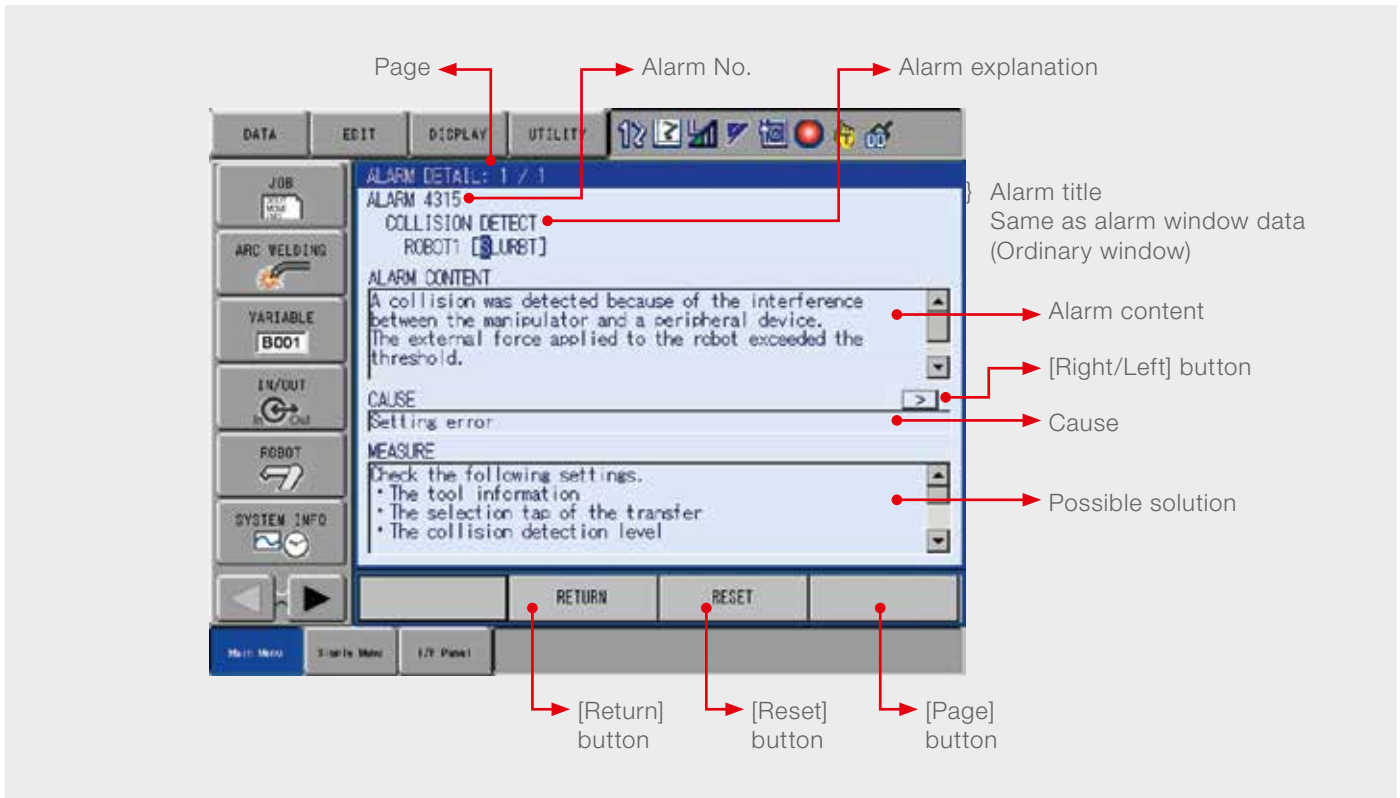
**User can specify the window to be shown
in case of alarm occurrence:**

• ALARM window (standard)
  => Press [SELECT] key to show ALARM DETAILS window
• ALARM DETAIL (parameter set)

Displays possible causes of the occurring alarm in descending order of frequency to help users find the countermeasure for each cause immediately.

If there are some possible causes and countermeasures for an alarm, press [Left/Right] buttons or [Left/Right] keys to see next "cause" and "measure". The "cause" and "measure" are displayed in the order to be executed.

If multiple alarms occur simultaneously, press [Page] button or key to switch to next alarm.

KEY BENEFITS

• Displays possible causes of occurring alarms
• Help user to find the cause of error immediately

CMOS Save with FTP **YRC1000 Ethernet Standard (181489)**

This function extends the functionality of the automatic backup function. It provides access to a generated CMOS backup by any FTP client. A notification message can be send whenever a new backup is available. To receive this notification message the backup client has to open a TCP server socket on a specified port.

KEY BENEFITS

• Allows to access the generated CMOS backup through any FTP client
• Get a notification message whenever a new CMOS backup is ready to download

REQUIRED SOFTWARE

• 181490_Function YRC1000 Ethernet FTP
• 181468_Function YRC1000 Automatic Backup

External Reference Point (181450)
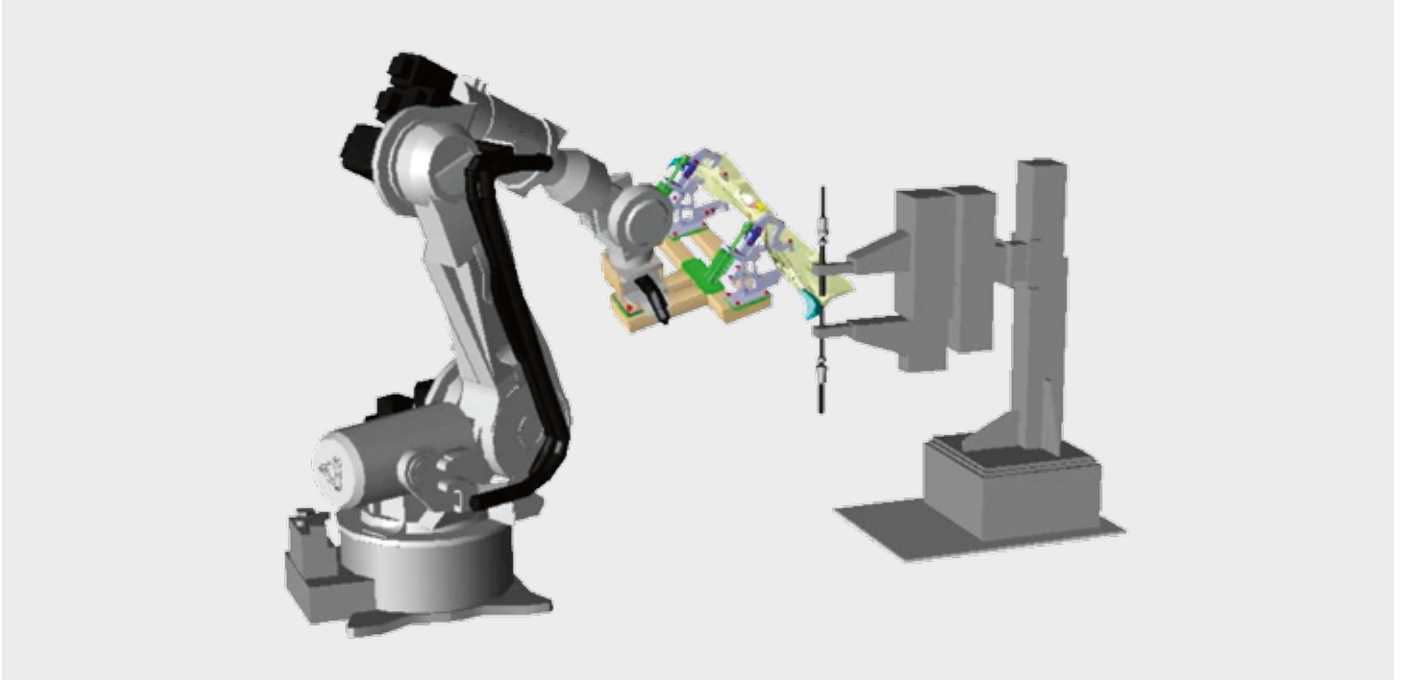
The "External Reference Point" control function performs teaching and playback, regarding one point in space as the control point of the manipulator. This one point in space is called the external reference point. Specifically, the point is used in the cases where sealing in the work piece supporting work or spot welding with the stationary tool is performed. In this case, operation such as changing the posture of a work piece can be easily carried out by setting the tip of tool, nozzle or gun to the reference point. Naturally, during playback, interpolation is performed by controlling the relative speed and relative position between the external reference point and the work piece.

KEY BENEFITS

- Quality is improved even for work piece supporting work with a fixed tool
- Teaching time can be reduced
- Applicable to more than one tool, gun or nozzle (63 external reference point)

System Job (181452)

Starts automatically after turn on the power of the cabinet and runs in the background.

System JOB
- *Start
- DELAY 100
- DIN LB000 SOUT#(441)
- DIN LB001 SOUT#(37)
- AND LB000 LB001
- JUMP *Start IF LB000=1
- SETUALM 8000 "Alarm"
- JUMB *Start

Work JOB
- MOVJ VJ = 100
- MOVJ VJ = 100
- MOVJ VJ = 100
- MOVJ VJ = 100

Starts when you go to play/remote mode and push start.
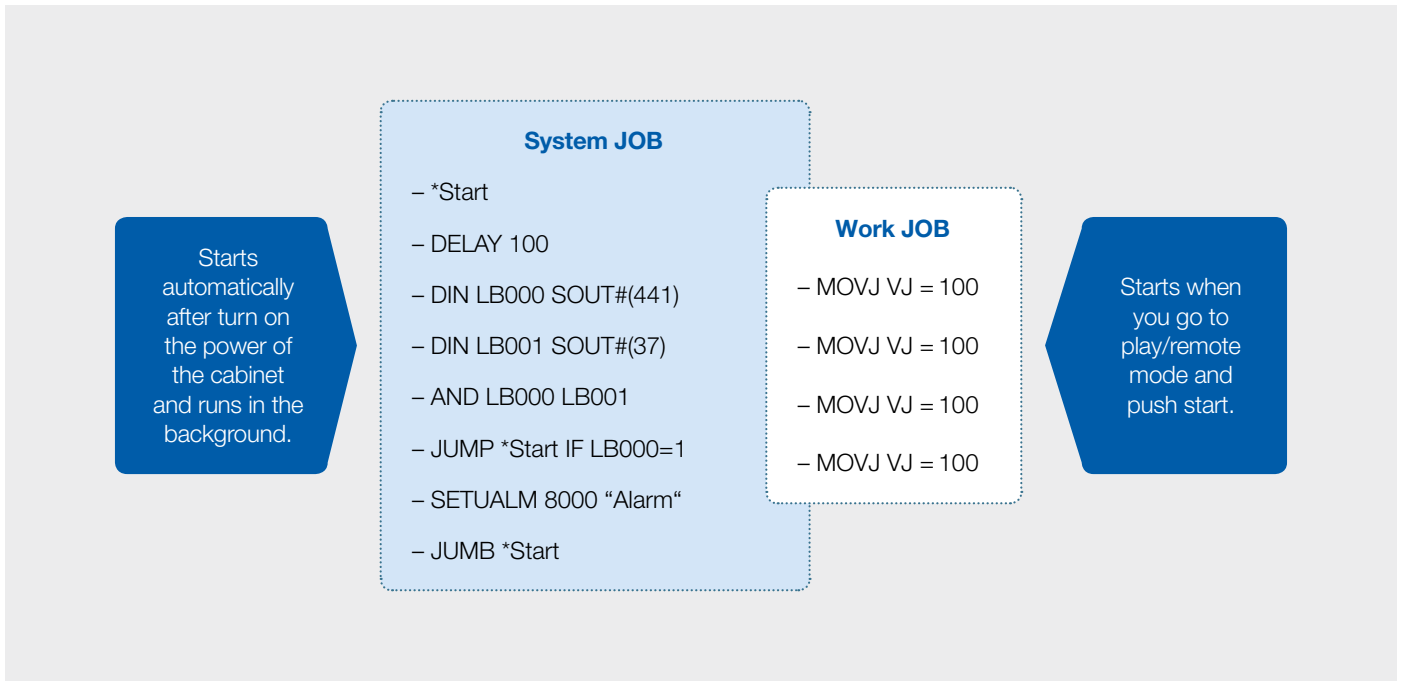
A "System Job" is a task that is started immediately and automatically after the controller has started. In comparison to a normal task (user task) neither start nor a stop is required to control such a task. So it is independent from operation mode (Play/Teach/Operating) and Servo On status. While usually motion or operation sequences (workflow) are programmed in normal tasks a system task is used to process cyclic tasks in the background. Up to 4 system tasks can be registered and run simultaneously in addition to normal job tasks.

Programs running in a system task are called system jobs. A system job is very similar to a normal job (user job) using the same Inform programming language but with a limited instruction set.

For example motion commands are not available. On the other side due to its similar characteristics it is sometimes used as a replacement for the internal ladder program. While the access of a ladder program is limited to IOs and registers, system jobs can process all available resources like variables, system variables, IOs and registers. On the other side in contrast to a ladder program the cycle time of a system task is not fixed. So processing time increases with each additional code line and is depending on current CPU Load.

Example:
- You can program a system job including a permanent check of collision detection function status
- When you are in teaching mode and the collision detection is OFF, nothing will happen. But when you are in play mode and the collision detection is OFF you will get an alarm e.g. with a reminder "Please turn ON collision detection while PLAY mode".

KEY BENEFITS

- Cyclic backround tasks in Inform language
- Auto start and independent from operation status
- Access to all resources
- Cycle time depends on number code lines and CPU load

Interrupt Job (181457)

Interrupt Job

NOP

END

Job in progress

NOP

END

Interruption

Interruption table

INTERRUPT JOB

Level	Signal	Jobname
	IN#01	JIG STOP

Interruption signal IN#01

Interrupt Jobs "JIG STOP"

NOP

END

Interruption

Job in progress

NOP

END
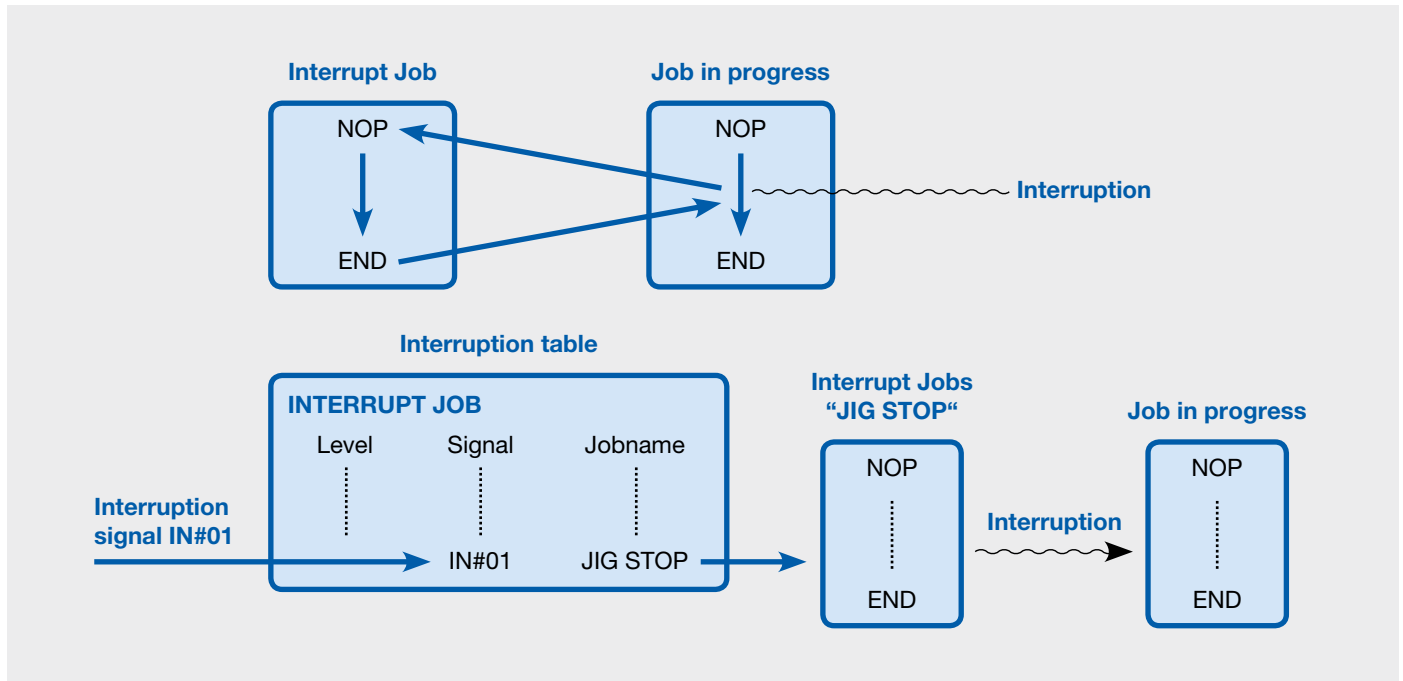
The "Interrupt Job" function is a kind of call job. When a signal to interrupt the job is sent from a peripheral device or another system, this function momentarily suspends a job in progress, and executes the job corresponding to the signal.

This function is useful when an error occurs in a peripheral device or in another system, or when the manipulator should be withdrawn in an emergency.

Sending a user input signal specified in the interruption table calls a job corresponding to that signal (IN#1 => job A; IN#2 => job B… etc.). When interrupt job is completed, the suspended job is restarted from the instruction line where the cursor was at the time of interruption. The instructions EI (Interrupt enabled) and DI (Interrupt disabled) are necessary to enable the interrupt observation.

KEY BENEFITS

- Interruptions are possible during move instructions as well as timer instructions
- Tact time can be reduced
- You can observe an area from your job
- For each robot you can create 8 interrupt jobs

TCP (181458)

1. After teaching with Tool A,
    put the undercoat using Tool A

2. With the TCP function,
    put the top coat using Tool B

Path taught with Tool A
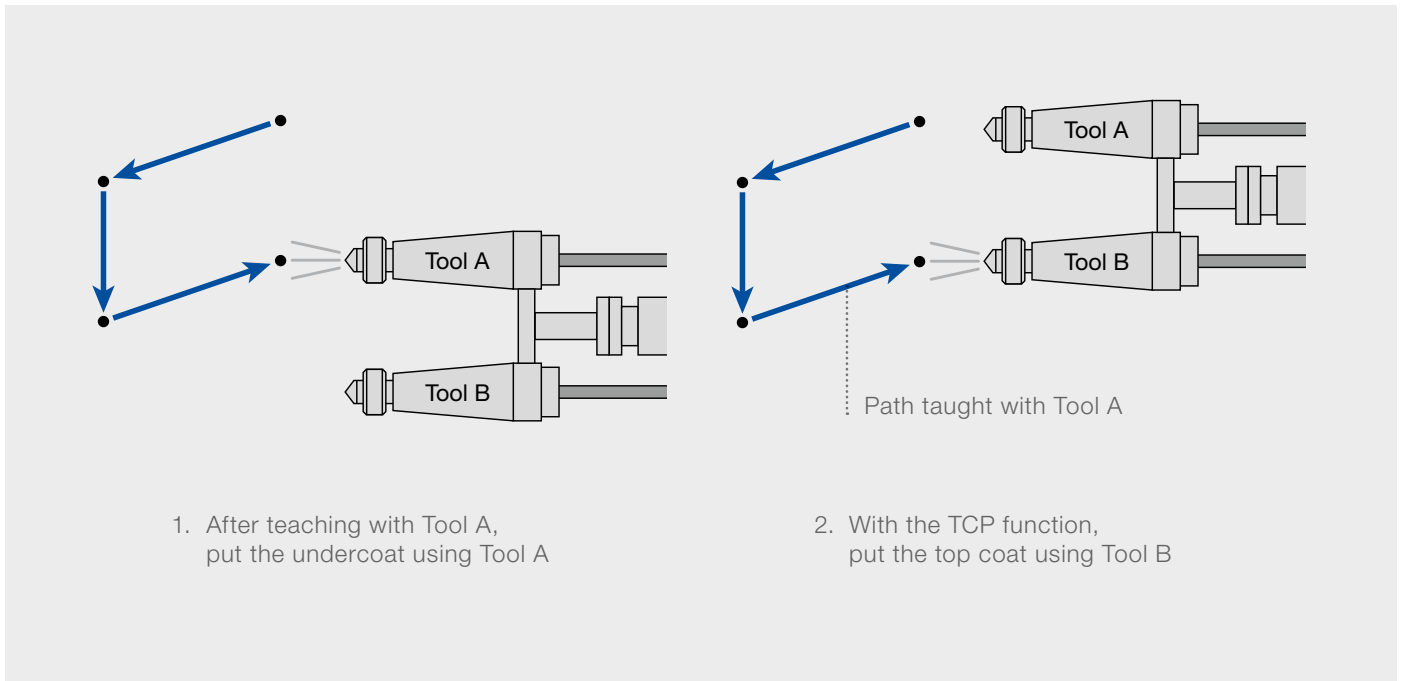
The "TCP" function (TCP: Tool Center Point) moves the tool along the track that was taught by another tool.

Quick programming of jobs (example):
• The job copied from the job taught with Tool A, defined a "Job A" can be defined as "Job B". Add the TCP instructions before and after the sections where Tool B is to be used in Job B. Set a tool file number for Tool B in the "TCPON" instruction.
• One tool is used for undercoat paint operation, the other is used for the top coat paint operation. Teach a path to either one of the two tools, then the teaching for the other tool is not necessary.

KEY BENEFITS

• Reduction of programming time:
  When moving double-tools along the same track, only one-time teaching is applied to each tool, which allows the job creation time to be reduced
• Precise tracking of both tools

Ladder Editor (181475)

Menu

Tool bar

"Ladder preview"

"Ladder editing" display
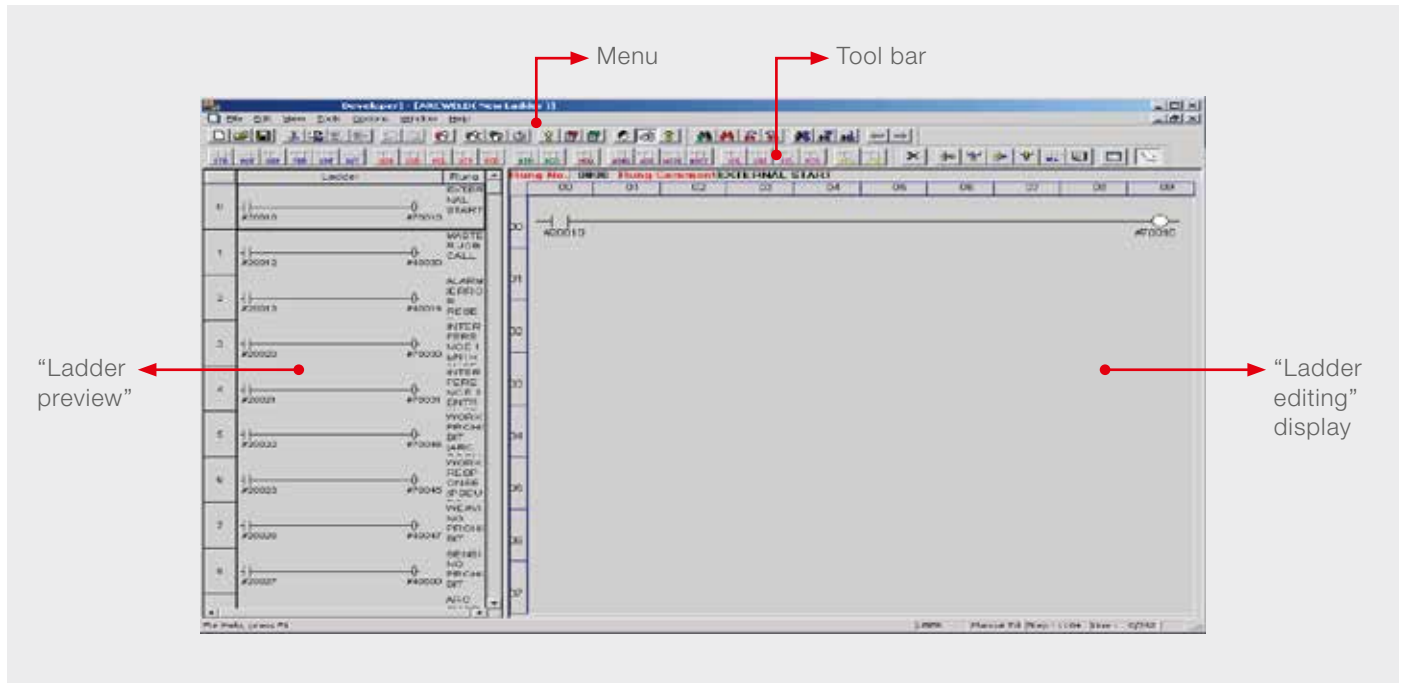
The robot controller has a concurrent IO function that processes IO related control independently from the manipulator, and in parallel with the manipulator operation.

Ladder software is used to graphically display ladder programs with the above function as a signal connection diagram or to edit ladder programs easily such as pasting command parts by a drag- and drop operation using the mouse.

Mnemonic Code

```
STR-NOT  #70013
STR-NOT  #70062
CNT      M256, M466
OR       #70096
OUT      #70104
. . . . . .
```

Ladder Diagram

Editing, Storing
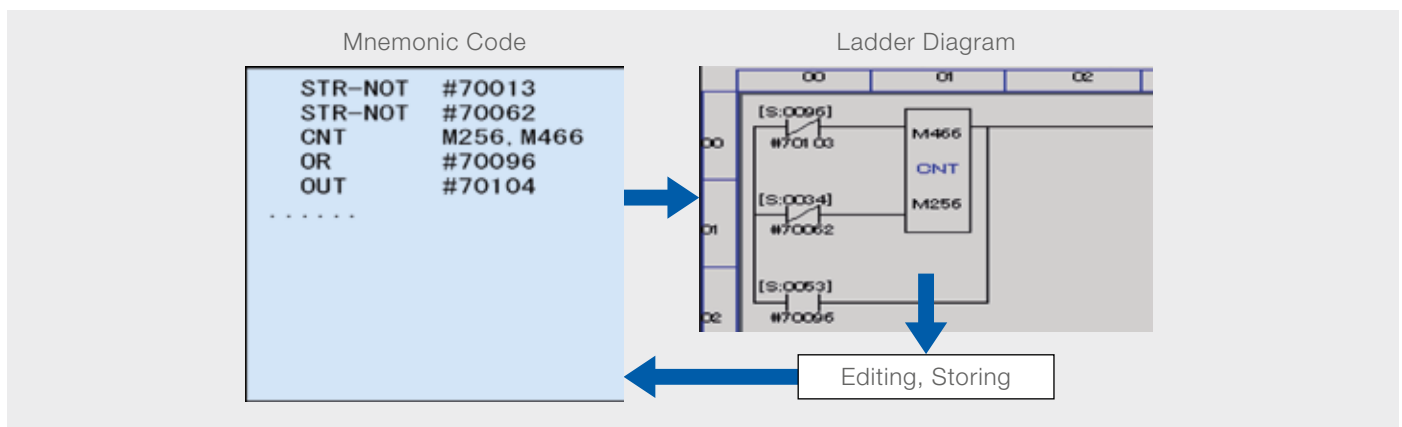
KEY BENEFITS

- Simple drag and drop operation
- Cross reference function is enriched
- History jump function is available
- Print function is enriched

Tag Data Replace (181487)
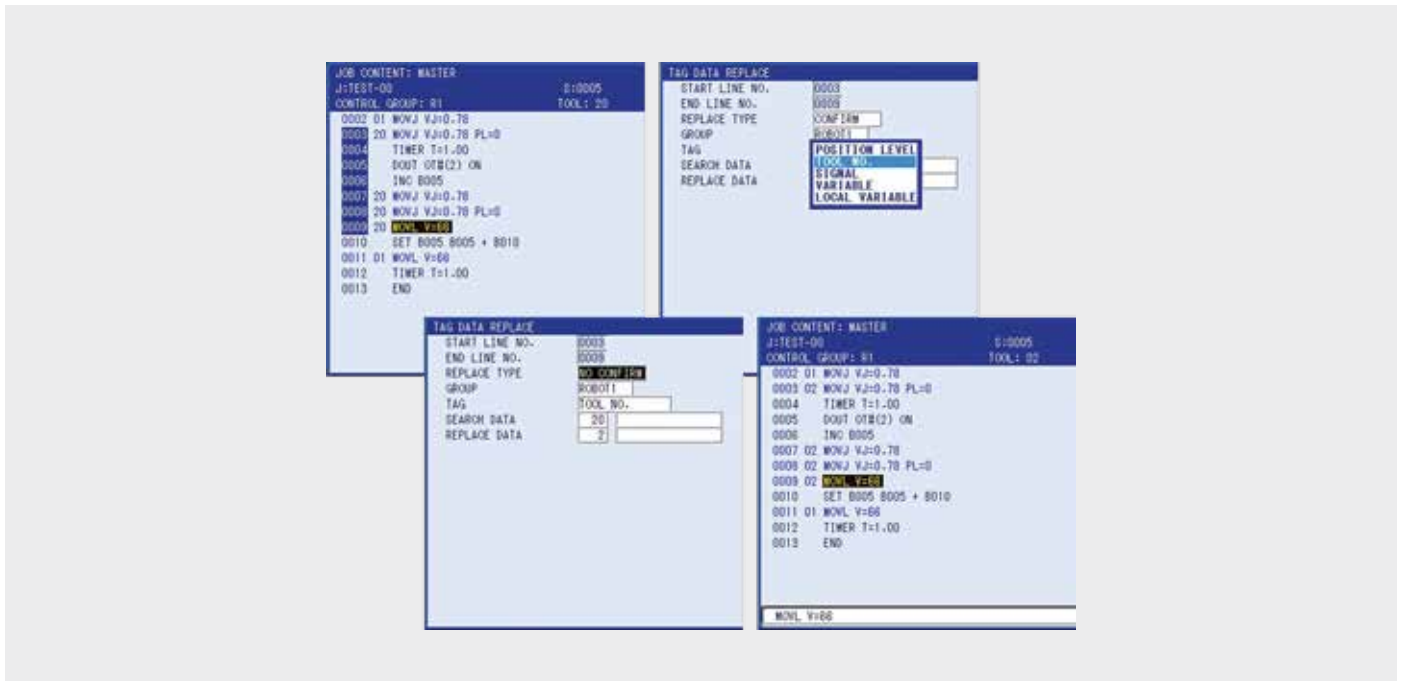
This edit function allows you to change data tags in one or more lines of a job at the same time.

Changeable line tags:
• Position level numbers
• Tool numbers
• Signal numbers
• Variable numbers
• Local variable numbers

KEY BENEFITS

• Teaching modification time is significantly reduced
• Tag data can be easily corrected in the window on the programming pendant

IO Output Timing Control (181481)

Distance adjustment (10.0 mm)
or
Time adjustment (1.00 sec)

OT#(x) ON
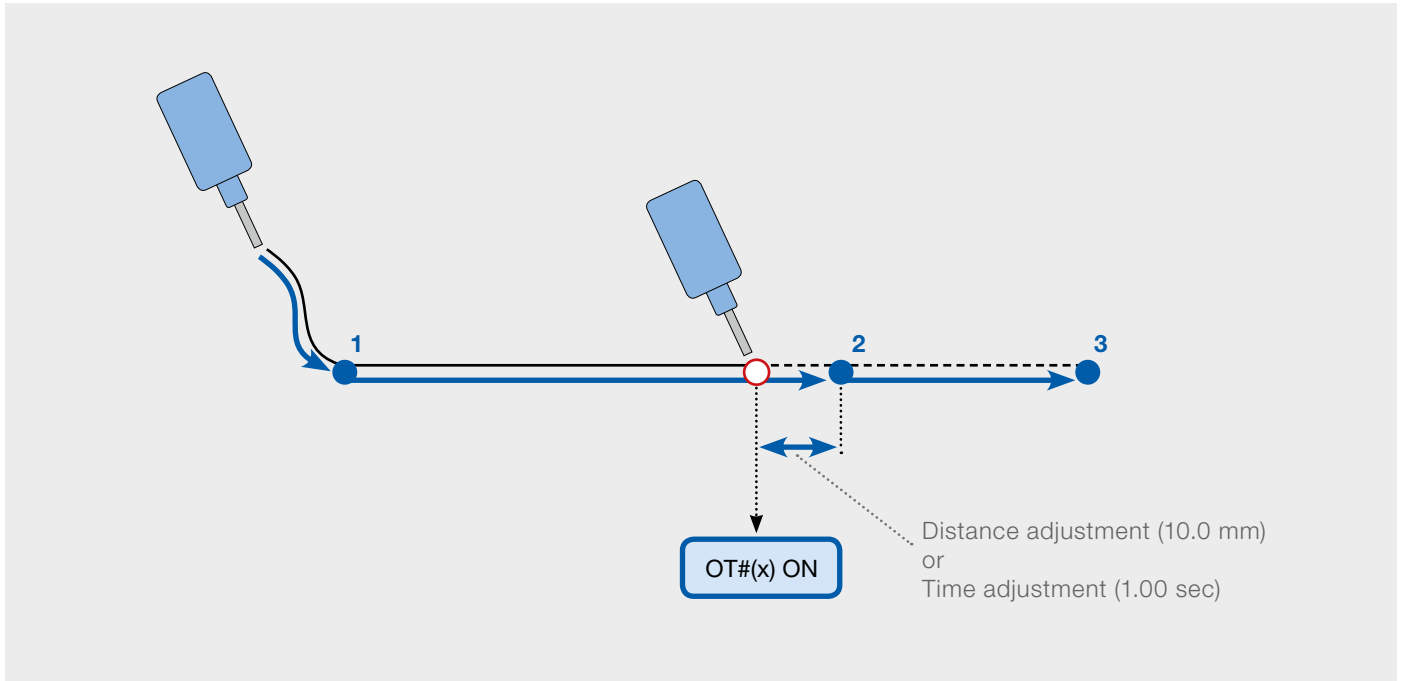
The "IO Output Timing Control" function allows the user to switch an output depending on the distance or time relative to a point.

The instruction is added directly behind the related motion tag.

The instruction is speed independent.

KEY BENEFITS

• Precise IO timing depending on robot position
• Speed independent

Feedback Position based PL (FPL) (181494)

Robot speed

Reference speed

FPL = ✦✦✦

FB speed

2

3

Execution timing of next step

```
NOP
MOVJ    1
MOVL    FPL = ✦✦✦    2
NOVL    3
END
```

FPL distance

1

2

Reference robot trajectory

Actual robot trajectory

Reference arrives the teaching point

3
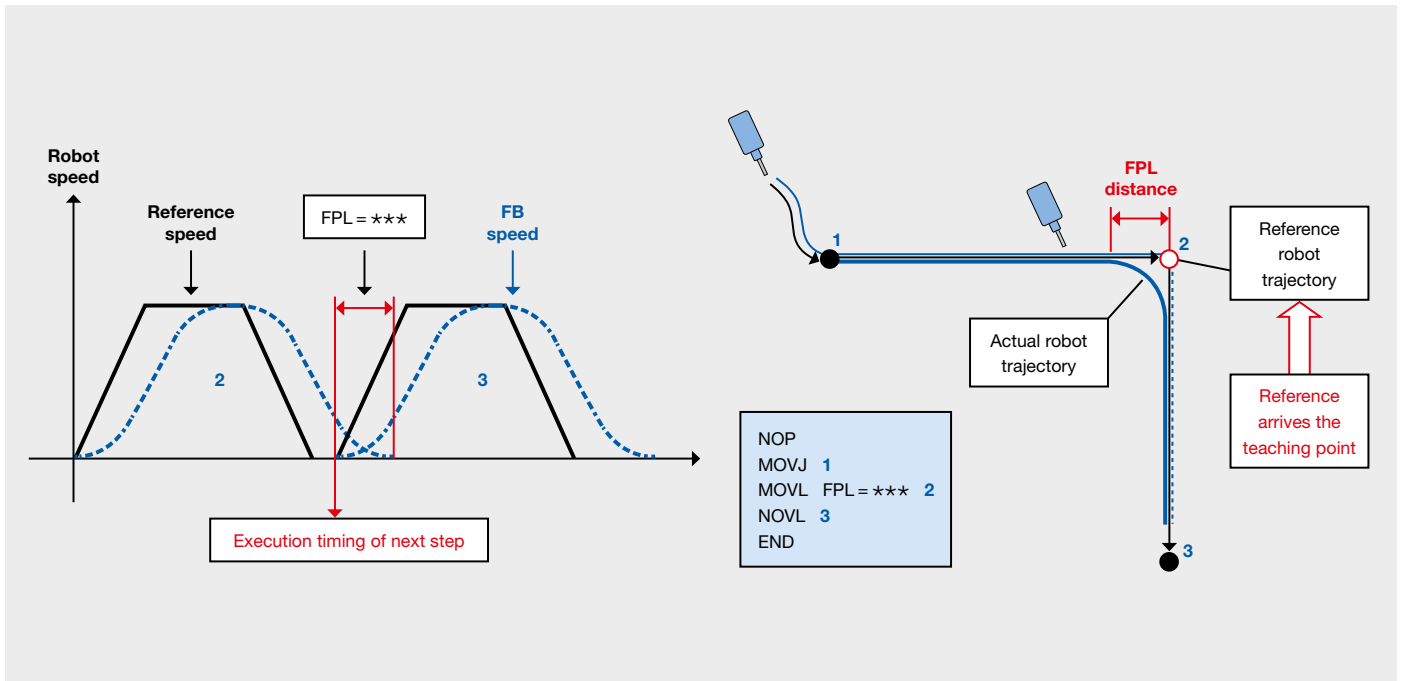
The "Feedback Position based" function can be set in mm based on the feedback position of the robot.

The "FPL" function is an upgrade from the "PL" function. The positioning distance can be set, based on mm before the next Step.

The next step is executed, when the actual robot position arrives FPL position.

KEY BENEFITS

• Acurracy can be increased
• Fine positioning can be set in smaller steps

Search Function (181455)

\<Robot Operation\>

Search start point

★

500 mm

P000

Manipulator Stop

No signal is input

Search start point

★

Signal is input

Manipulator Stop

Signal is input
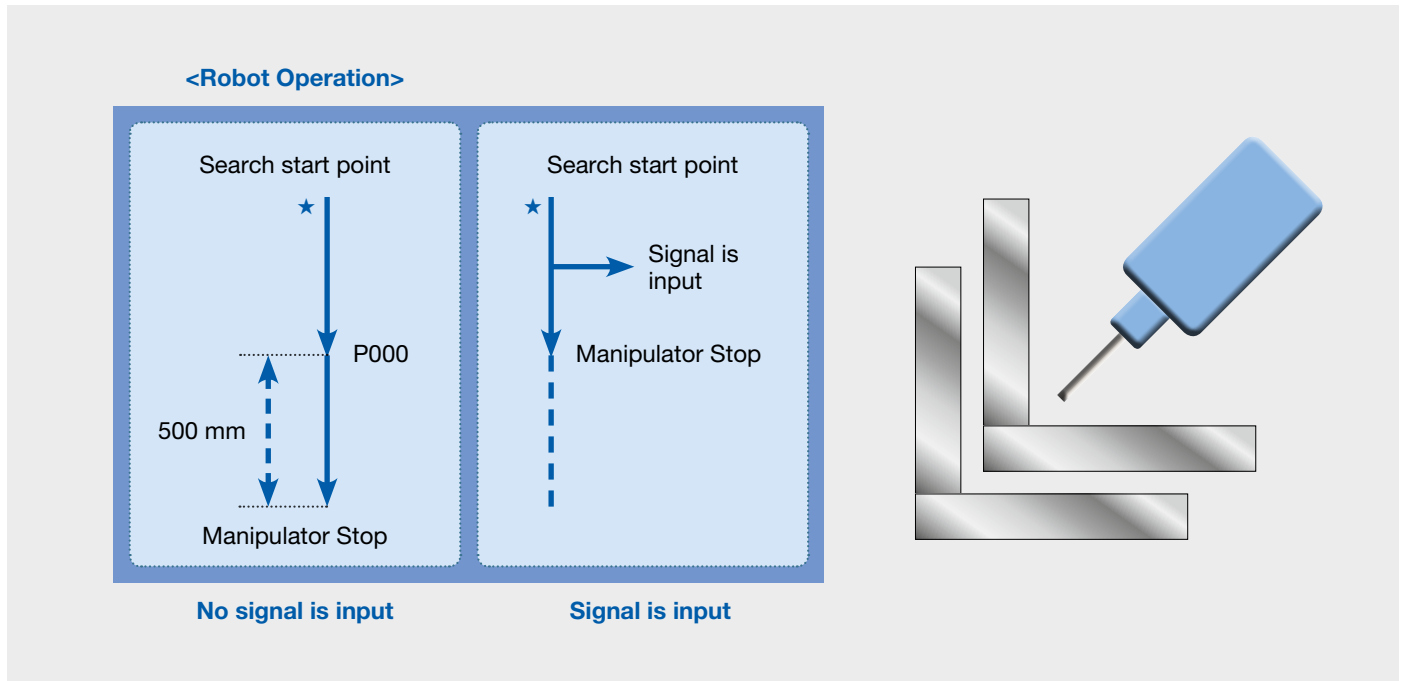
"Search Function" uses various general detection sensors to stop the robot by the detection signal of the sensor and to allow the robot to operate the next work. That is to say, this function searches the target to be worked.

From the start position (★ mark) to the position defined by the variable P000, the robot operates by linear interpolation at a speed of 10.0 mm/sec. At the same time, after the robot operation starts, the function starts monitoring whether a signal is input to DIRECT IN No.1.

After the operation starts, as soon as there is a signal input, the robot stops. If there is no signal input, the robot stops at a distance of 500 mm ahead of the position defined by P000. In that case, whether the robot stops with or without a signal input can be determined by the value of the system byte status $B02.

KEY BENEFITS

- Although normal programs require a teaching procedure for each work piece, this function allows the robot to move in search of work pieces, which simplifies the program
(Refer to the program on the left side of this page.)

Manual Brake Release (181476)
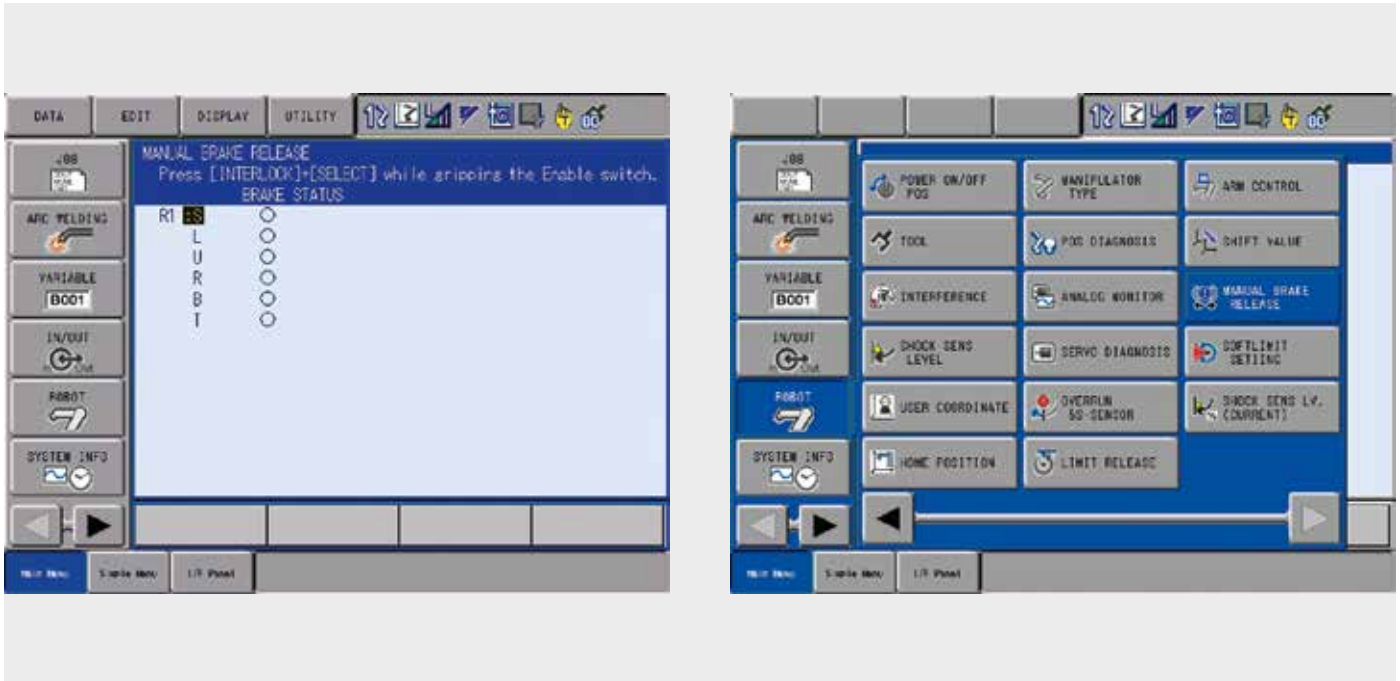
The "Manual Brake Release" function allows forcible release of each motor brakes of the manipulator and external axes by programming pendant operation.

KEY BENEFITS

• The robot and external axis can be moved without power connection

Teaching Point Adjustment (181461)

The "Teaching Point Adjustment" function modifies the taught position data by entering the numeric number on the programming pendant without operating the manipulator.

This function allows simplified offline teaching with CAD data or others, and allows fine adjustment of position data in any coordinate system without operating the manipulator.

KEY BENEFITS

• Teaching modification time is significantly reduced
• Position can be easily corrected in the window on the programming pendant

Shift Condition Cancel (181465)

"SHIFT ON" executed shift value →

Original position

Temporary new position

Reteach necessary offset →

Function disabled!

Wrong!
Shift value included!

**New position after modification:
Result in relation to origin position**

Function enabled!

Okay!
No additional offset by shift value!
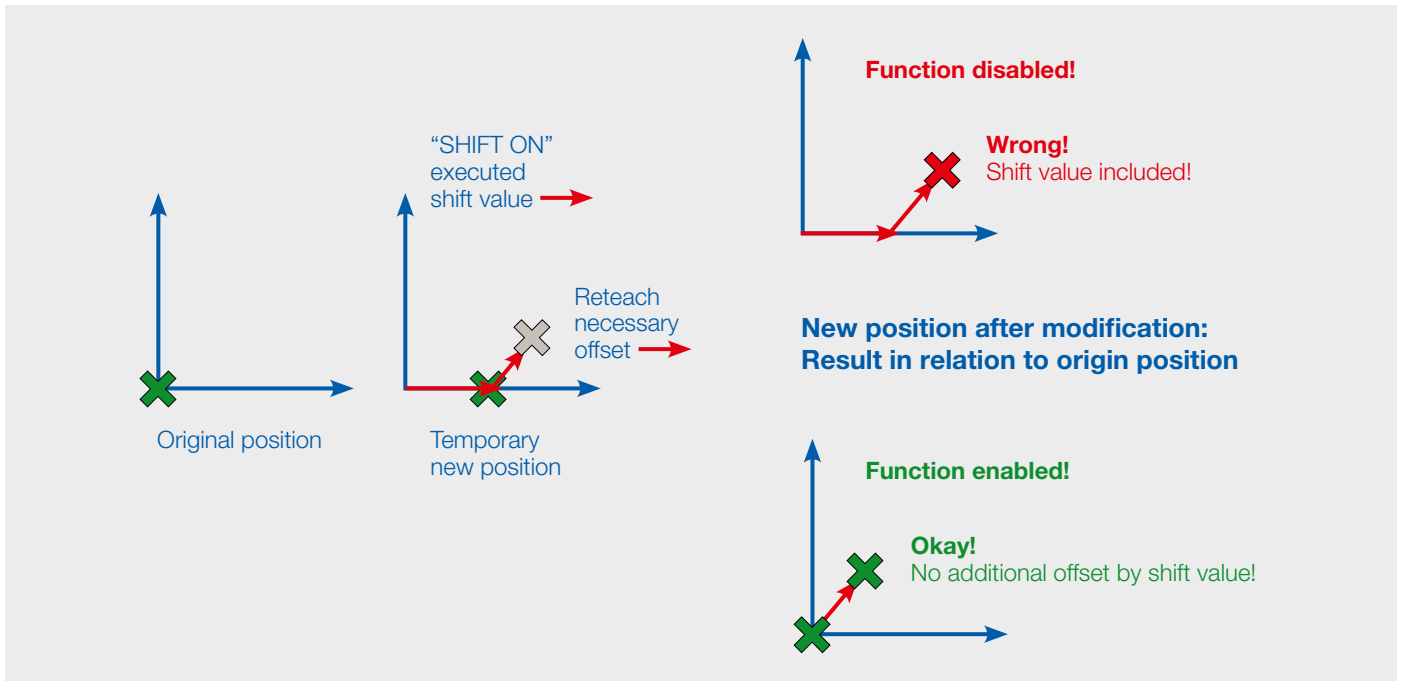
This function should be always enabled, when "shift on" instruction is used for programming!

It allows to overwrite (reteach) robot positions under consideration of current shift-values.

KEY BENEFITS

- No "master workpiece" with original programming necessary
- Reworks on existing "SHIFT-programmes" are easy and comfortable
- Temporarily shifted points can be overwritten (modified), independently from current shift values

Interface Panel (IF-Panel) (181469)

Status displayed by lamp

Operation by the button and switch

Variable and register values displayed by counter

Variable and register values set and displayed
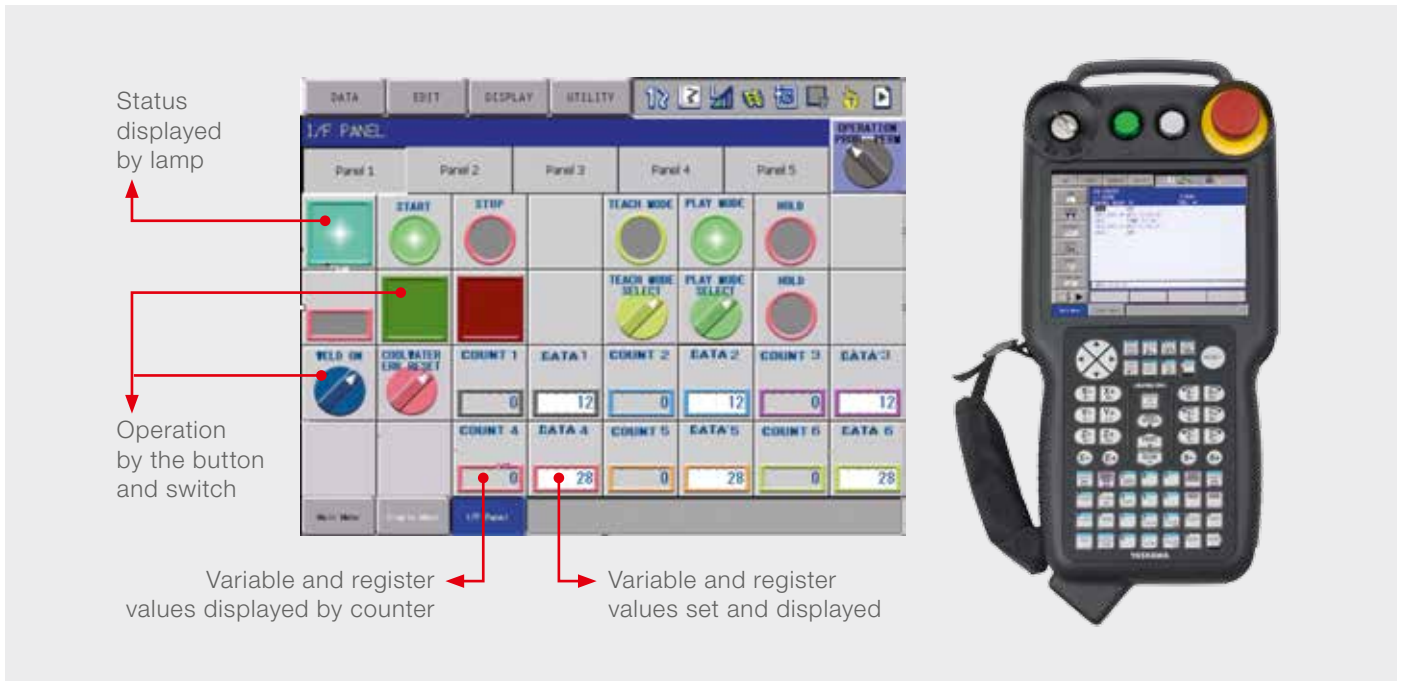
A virtual operation panel can be constructed in the programming pendant.

Configuration with software provides flexible support for rapid system change.

This function makes the system construction simple and enables the reduction of operation panel and Interlock panel.

Users can construct the arbitrary operation panel for PP by setting data in Interface panel setting screen.

KEY BENEFITS

• No additional hardware is required
• Pendant operation allows for cost cutting on the system

Point Variable (T-Variable) (181462)

Detail A
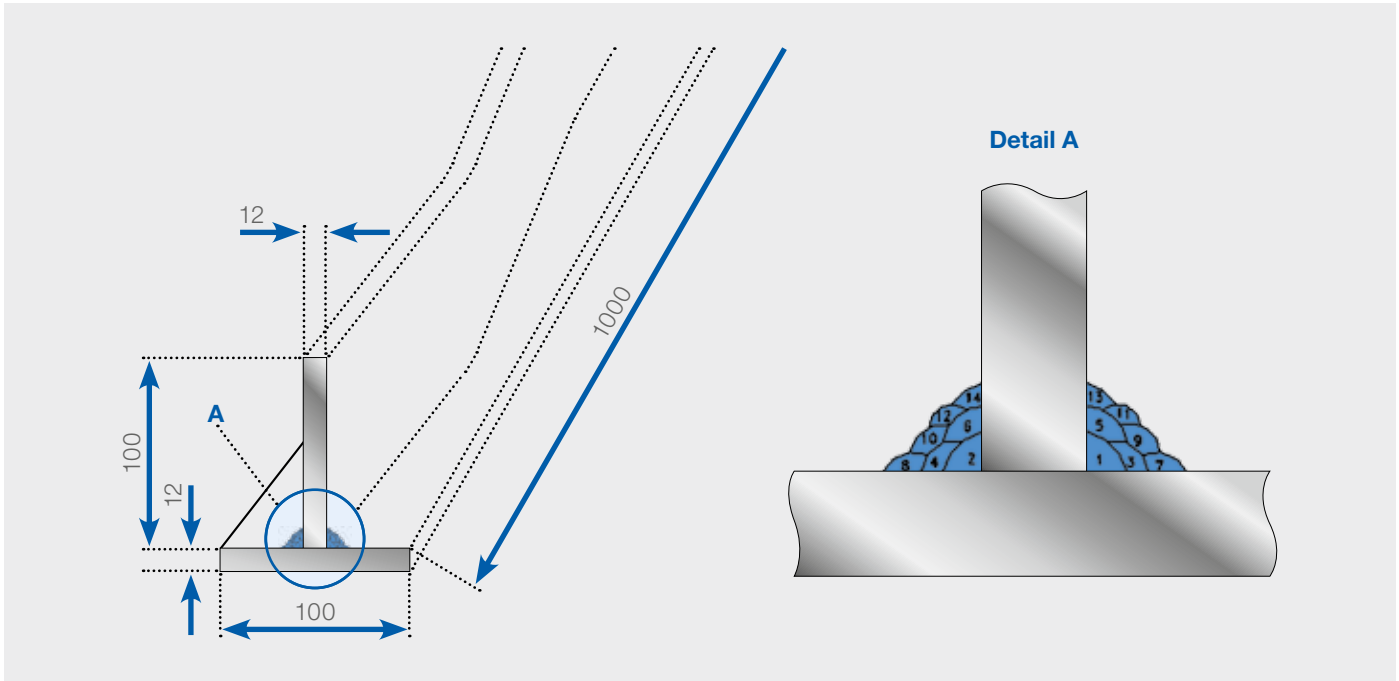
This function is fixed part of Multi-Layer function package. The special type of position variable has been created to simplify the programming of multi-layer welding structures (figures above). All welding passes basically have the same robot position. The only difference is the (variable) shift amount from root pass to current layer. Only the first layer must be taught by moving the robot. These positions will be registered as T-variable and in your JOB you can use same positions as often as necessary (number of layers) without moving the robot again.

The main difference to standard position variable (P-variable) is the "local" character: That means all information are stored in current JOB and each determined T-variable belongs only to the JOB where it has been set. Same

T-variable (number) can be used in different JOBs and may have different position information! P-variable on the other hand has "global" character and if it is set once, it is commonly valid in all controller areas.

Using the T-variables is not mandatory but the more layers you have to teach, the more useful these T-variables will become.

KEY BENEFITS

- Simplifies programming on multi-layer seams
- Helps saving memory space
- Substitutes limited P-variables
- Up to 9999 T-variables for each JOB
- Offline editing possible

Search Continuous Motion (181467)
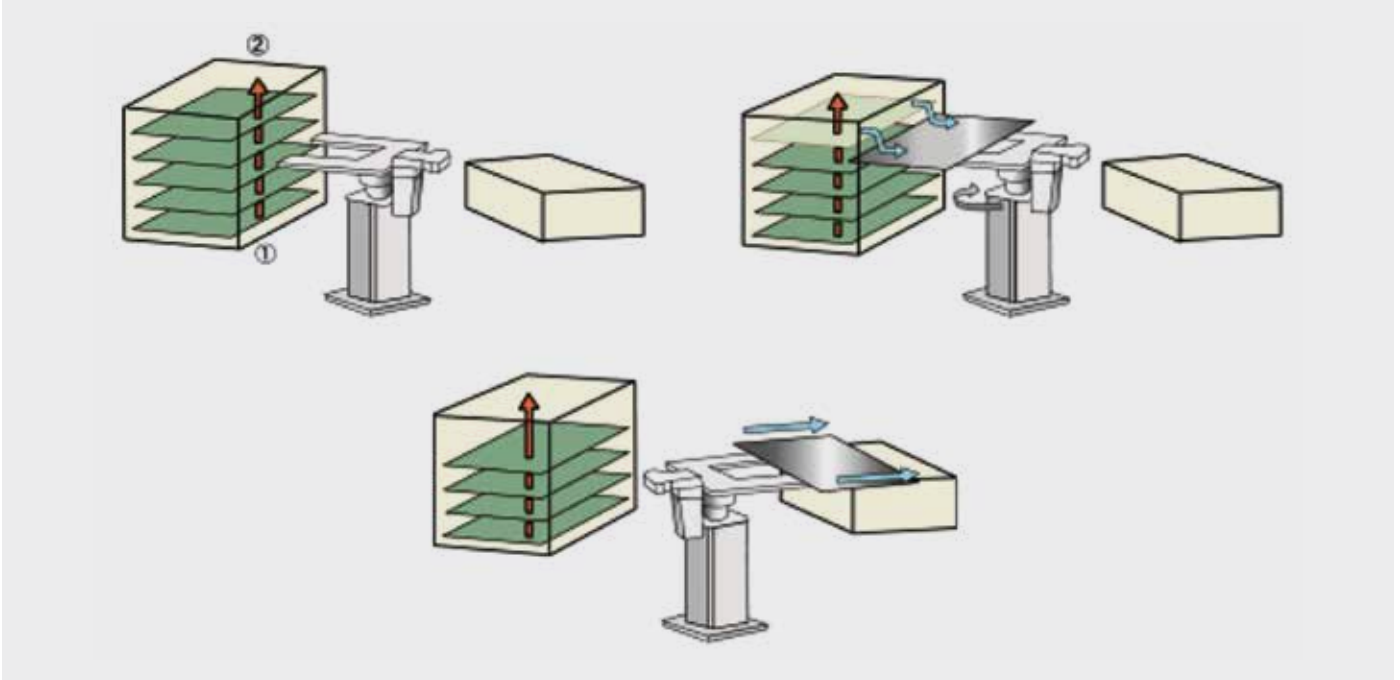
The "Search Continuous Motion" function holds the data of up to 50 positions where the YRC1000 detects digital signals from general sensors during job execution while moving over some parts in one line without stopping the motion.

Detects also the up to 50 positions of circular placed parts with an circular movement.

Programs can be simplified, because normal programs require a searching procedure for each work piece, this function allows the robot to search all the work pieces in one line with only one movement and one NSRCHON command which simplifies the program.

KEY BENEFITS

- Fast possibility to find each position of more parts in one line with only one movement
- Saving cycle time
- Simplified robot job's, saving programming time

Numerical Input Screen Display with Direct Open (181484)

Before

After

Main Job Screen

Position Screen

Numerical Input Screen
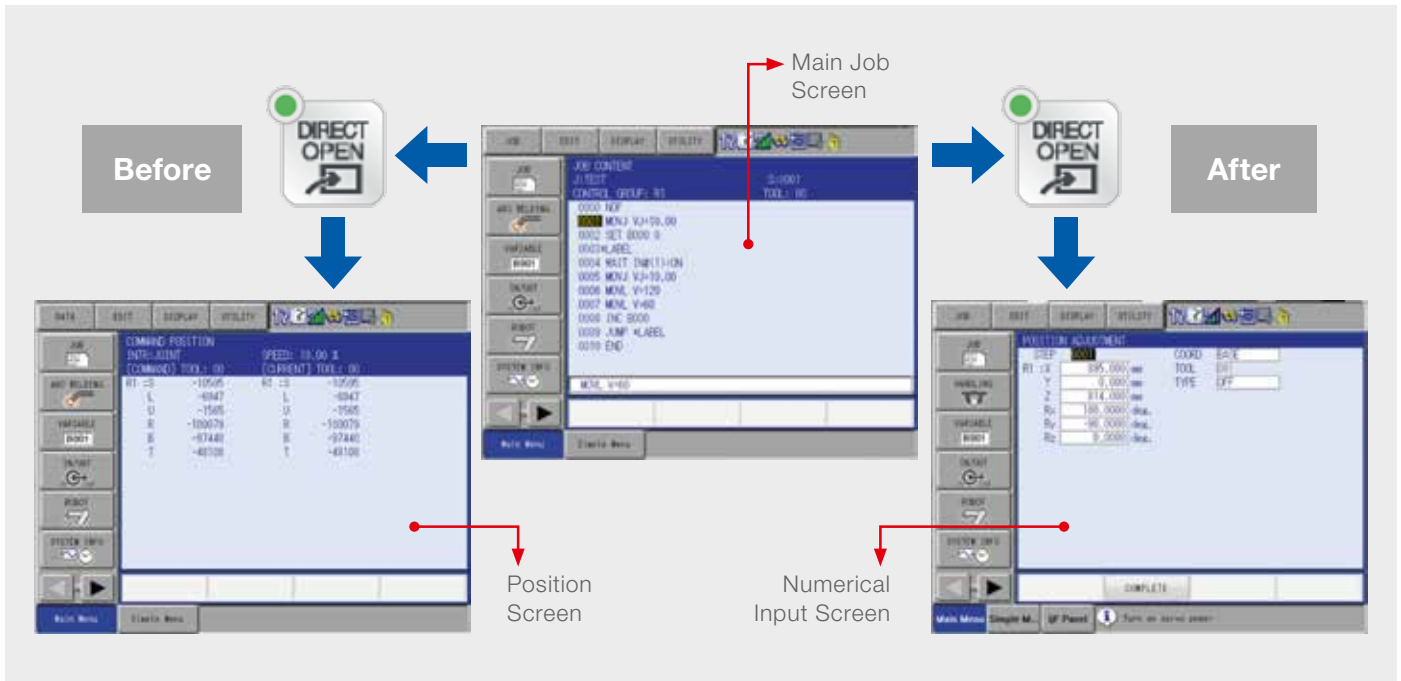
The "Numerical Input Screen Display with Direct Open" function by pushing the direct open key immediately shows the registered position data correction screen.

(Note: Only works if option function "Teaching Point Adjustment" is activated).

KEY BENEFITS

• Easier and faster online teaching

Weaving Adjustment (181485)

50 mm

k

2 mm

4 mm

6 mm

Teaching
position

Teaching
position

This function can be used to compensate variable conditions in a welding groove by continuous adapting of weaving parameter and speed.

The information about groove conditions can be set manually as constant values, or can be set automatically by measuring device like touch sensor or any other start point detection unit: Please check feasibility in detail with technical department.

FUNCTION OVERVIEW

• Weaving amplitude will be continuously increased
• Robot speed and weaving frequency can also
  be adapted if needed

KEY BENEFITS

• Extension of standard weaving function
• Available for application "general" and "arc welding"
• Function is also optional part of adaptive welding routine
  in MotoEyeLT software (see picture above:
  gap condition file), if laser seam tracking is used

Advanced PP Customization Runtime (181512)

The "Advanced PP Customization Runtime" is required to run applications developed with "Advanced PP Customization" SDK. The SDK is a collection of modules for creating customized user interfaces for the programming pendant. The customized UI overlies the standard UI so it's possible to make important controls and informations easier to reach and create a unique interface concept across multiple devices.

The SDK comes with different function modules which can be easily adapted in customized applications. These modules provide functionalities like event based variable access, logging, multi language support, custom UI elements, …

KEY BENEFITS

- Custom UI elements
- Multi language support
- Event based variable handling. Get notification when a variable is changing
- Visualize the state of variables by connecting to custom UI elements
- Support for different user levels
- Logging
- Template for creating new applications
- Application is based on .NET 3.5 compact framework
- Visual Studio 2008 required for development
- Sample application which implements all available features

REQUIRED SOFTWARE

- "Advanced PP Customization Runtime" – The runtime is required for each controller that is running a customized UI. 1 runtime license is already included in the "Advanced PP Customization" SDK

MotoPlus Runtime (181513)
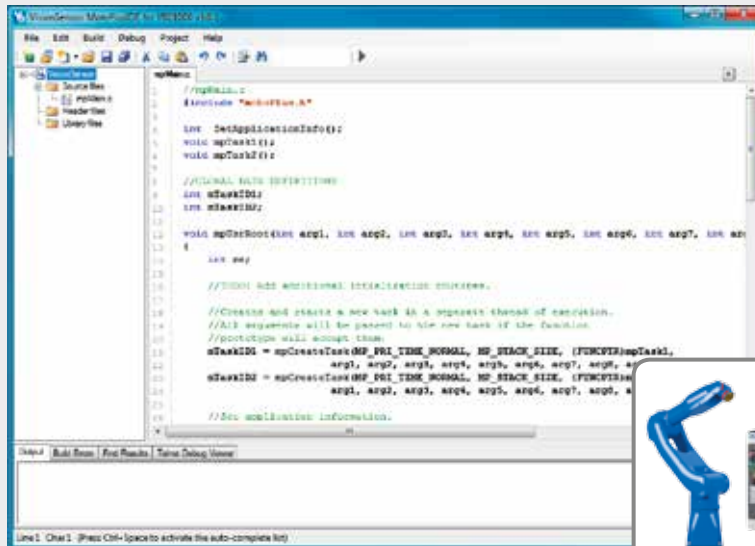
The "MotoPlus Runtime" is required for running applications built with the MotoPlus SDK. The SDK provides a complete programming environment for creating applications based on the C language that are executed onto the controller. The SDK provides access to the following APIs:

• Task Control API
• Network API
• Serial Communication API
• System Monitor/Control API
• Motion Monitor/Control API
• Sensor API
• File API

KEY BENEFITS

• Required to run applications built with the MotoPlus SDK
• Run multiple MotoPlus applications per controller
• Runtime license required for each controller
• MotoPlus SDK for developing applications

OPTIONAL SOFTWARE

• MotoPlus SDK – Development environment for creating MotoPlus applications
• 181529_F-Pkt YRC1000 MotoGSI – MotoGSI is a development package for creating communication interfaces with inform

PMT (181456)

Tool at teaching (Original tool)

Deformed tool
(Orientation tool)

Dislocation of tool center point

```
0016 MOVJ
0017 WAIT IN#(1)=0
0018 MOVL V=70
```

Position data of the step taught
by the original tool is converted
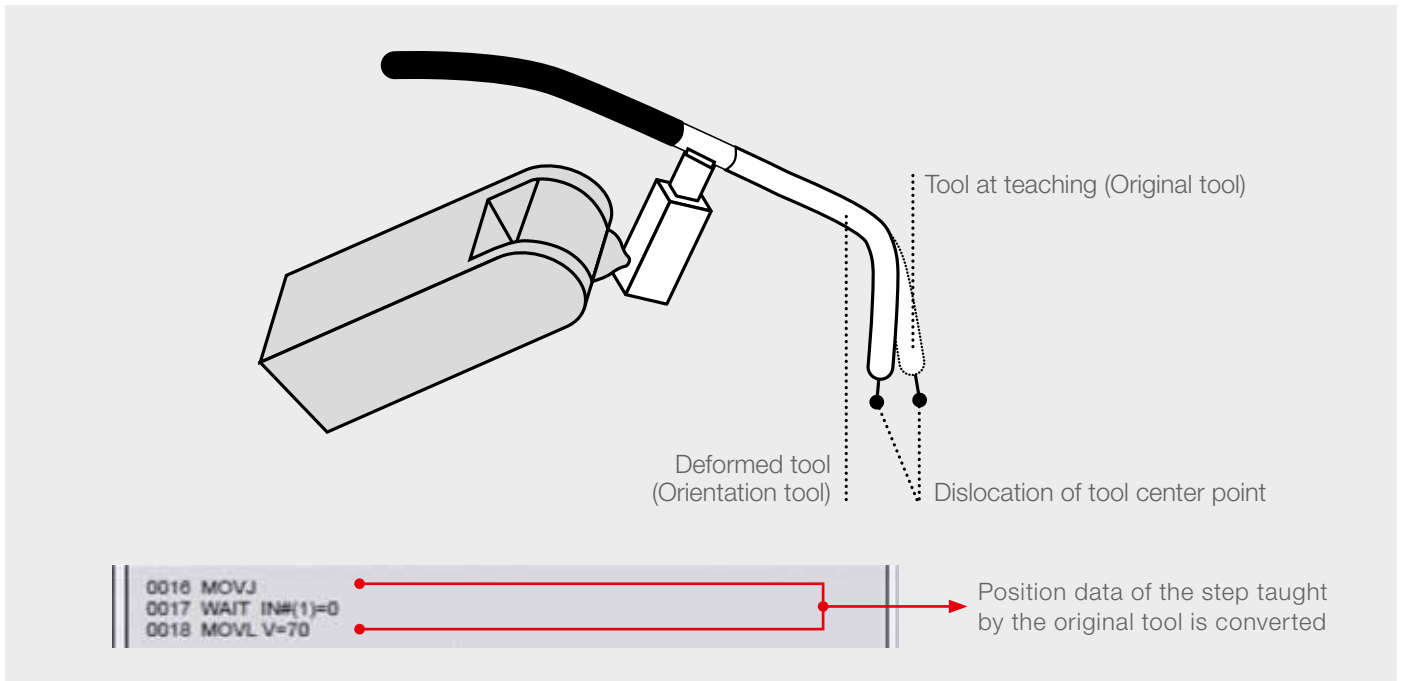
"PMT" function easily and accurately modifies positional data if the tool is deformed. (PMT: Position Modification for Tool deformation: position data modification function for tool deformation).

If the tool accidentally collides with a surrounding jig or wall and is deformed, the control points are shifted. As a result, teaching positions in the job that has been taught are also shifted.

"PMT" function allows time and works for modifying the shift to be reduced. When a job is specified, the position data of the tool dimensions before the deformation (during teaching) is automatically converted to the position data of the tool dimensions after the deformation.

The tool before modification is called the old tool, and the tool after the deformation is called the new tool in "PMT" function.

KEY BENEFITS

- Time and work for teaching modification can be reduced. Teaching modification work can be efficiently performed because position data can be automatically converted from the old tool to the new one.
- Storing tool data record can easily restore original tool data. The original tool data can be easily restored because the change record of the tool constant can be checked in the "Tool Backup" window.

Speed Control (181496)
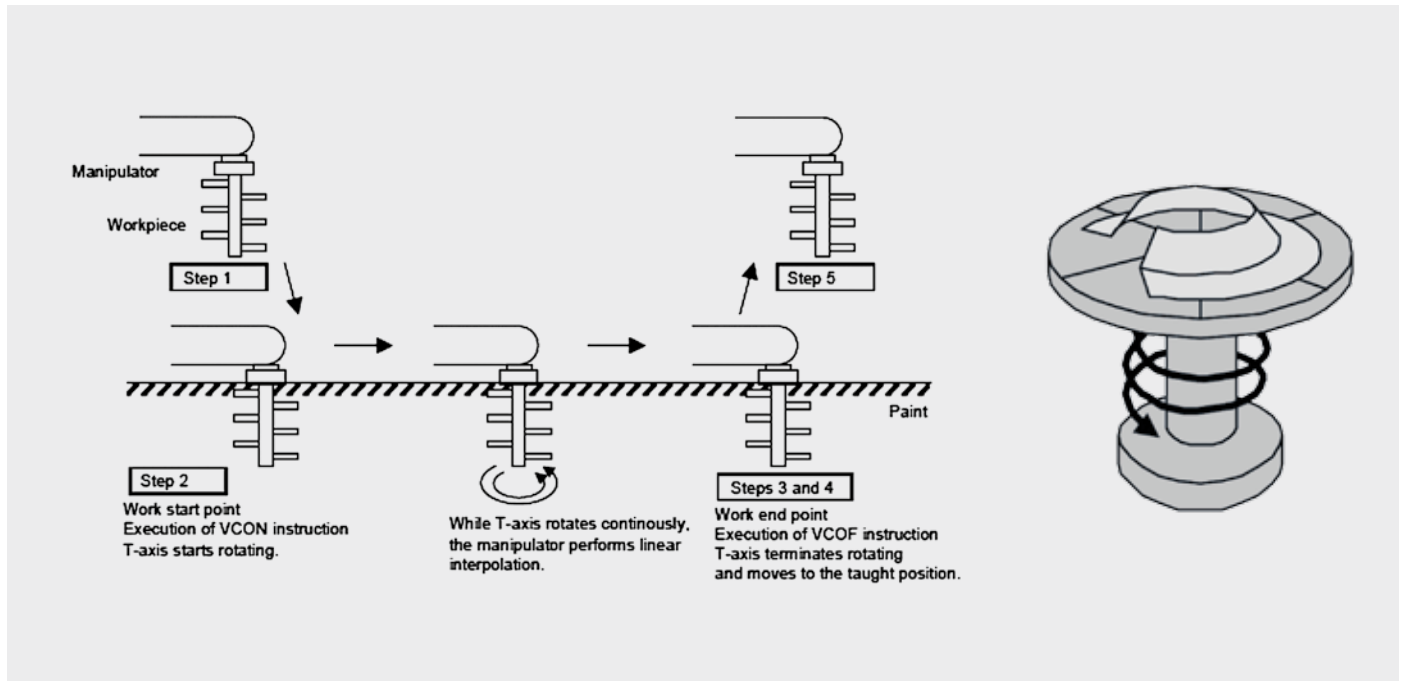
With the "Speed Control" function, the T-axis, the end tip axis of the manipulator, or the external axis (hereinafter referred to as the speed control axis), can be continuously rotated according to the specified rotation speed.

During the continuous rotation, the rotation speed of the speed control axis is independently controlled. When operating the manipulator with the "Speed Control" function, the speed control axis rotates at the specified speed disregarding teaching while other axes operate as taught.

Line	Step	INFORM Instruction	Explanation
0000		NOP	
0001	0001	MOVJ VJ=12.50	Moves to the waiting point.
0002	0002	MOVJ VJ=12.50	Moves to the work start point.
0003		VCON ROBOT=1 JOINT=6 RPM=1000	Starts rotation of the T-axis of the manipulator 1. Rotation speed: 10.00 [rotation/min]
0004		TIMER T=0.50	Waits for rotation to start.
0005	0003	MOVL V=100	Moves to work end point by linear interpolation at 100.0 [mm/sec].
0006		VCOF ROBOT=1 JOINT=6	Terminates rotation.
0007	0004	MOVJ VJ=12.50	Moves T-axis to the taught position.
0008	0005	MOVJ VJ=12.50	Moves to the waiting point.
0009		END	

KEY BENEFITS

- Teaching time can be reduced.
- Working efficiency can be improved.
- The speed control axis rotates at the specified speed disregarding teaching

Link Servo Float (181459)
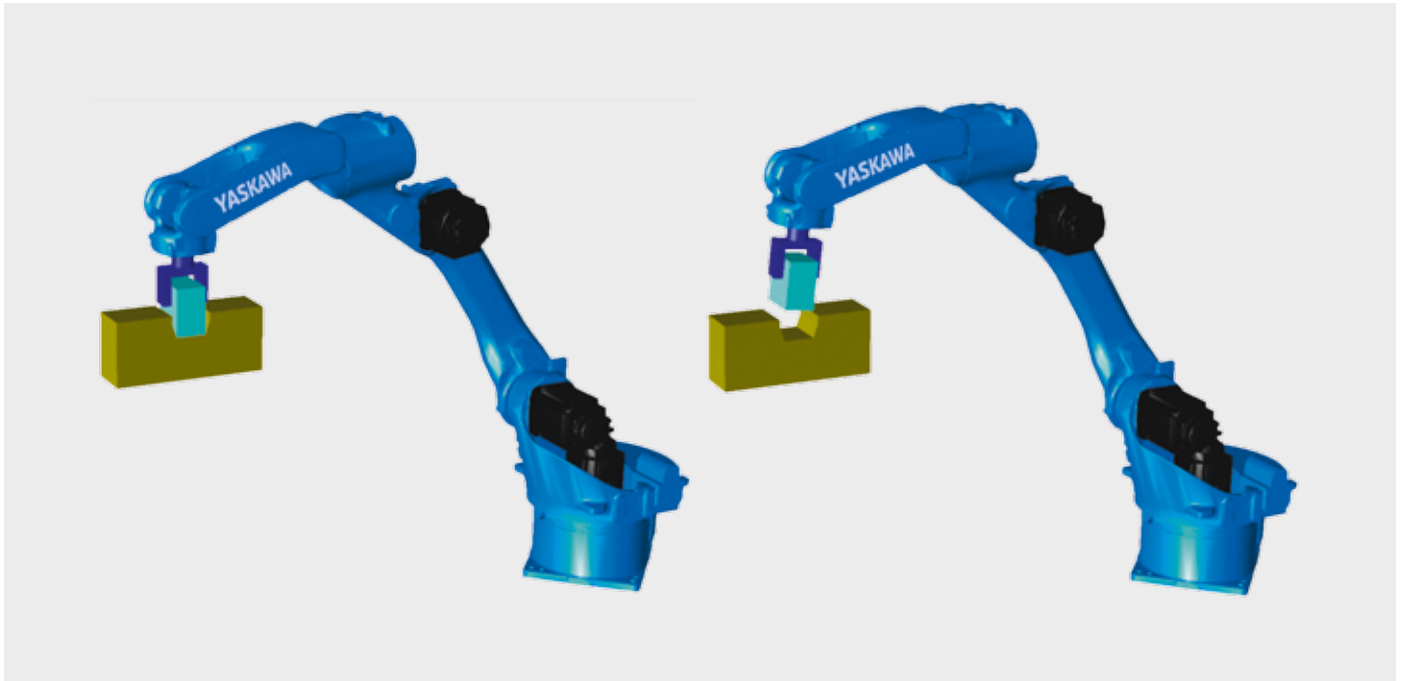
The "Servo Float" function controls not only the position of the robot but both the position and force of the robot. Normally, even if an outer force is applied to the robot, the robot tries to maintain the current position and does not move because only the robot position is controlled. In that case, the "Servo Float" function provides flexible control on the position and posture of the robot, in response to the force applied from outside. It allows to overwrite (reteach) robot positions under consideration of current shiftvalues.

Link Servo Float function
This function performs the servo float for each axis of the robot, for every robot separately. It is used when a force is applied only to a specific axis or when the servo float is applied to all axes of the robot because the direction in which the force is applied cannot be identified.

KEY BENEFITS

• No additional hardware is required
• **Link Servo Float function**
  Can be activated by programmer for each axis
  or all together

Link and Linear Servo Float (181460)

The "Servo Float" function controls not only the position of the robot but both the position and force of the robot. Normally, even if an outer force is applied to the robot, the robot tries to maintain the current position and does not move because only the robot position is controlled. In that case, the "Servo Float" function provides flexible control on the position and posture of the robot, in response to the force applied from outside. It allows to overwrite (reteach) robot positions under consideration of current shiftvalues.

Link Servo Float function
This function performs the servo float for each axis of the robot. This function is used when a force is applied only to a specific axis or when the servo float is applied to all axes of the robot because the direction in which the force is applied cannot be identified.

Linear Servo Float function
This function performs the servo float for each coordinate axis of coordinate systems such as the robot coordinate, base coordinate, base coordinate, user coordinate, and tool coordinate. This function is used when the force is applied only to the specific direction of each coordinate system.

KEY BENEFITS

- No additional hardware is required
- **Link Servo Float function**
  Can be activated by programmer for each axis
  or all together
- **Linear Servo Float function**
  Can be activated by programmer for each coordinate
  system in each direction

MotoSight2D Interface (181516)

"MotoSight2D" is a fully integrated hardware/software 2D vision solution. It enables the robot controller to communicate with Cognex In-Sight sensor devices. Included with "MotoSight2D" is a pendant application that is used to assign supported vision tool results directly to robot variables for use in robot programs. Image captures as well as vision tool graphics appear directly on the programming pendant display screen. Using the pendant application, vision tool settings can also be modified directly from the programming pendant.

KEY BENEFITS

- MotoSight2D features an easy to use graphic interface
- Display current camera image and vision result on the programming pendant
- Easy assignment of vision results to robot variables
- Modify vision tool settings directly from the programming pendant
- Manage up to 4 cameras
- Set of macros to embed the vision task in robot programs

REQUIRED FUNCTIONS

- 181513_Function YRC1000 MotoPlus Runtime –
  The MotoPlus runtime is required for running applications built with the MotoPlus SDK

T-axis Endless (181451)

This function continuously rotates the T-axis a plural number of turns. Although the rotation angle of the T-axis is generally limited within ±360 degrees, this function allows it to rotate endlessly. When executing the move instruction MOVJ with the "number of rotations of the external axis" specified, the T-axis rotates the "specified rotating amount + teaching position pulses" during the movement to the target position. One move command can specify up to ±100 turns.

KEY BENEFITS

• No turn back of the T-axis is neccassary
• Teaching time can be reduced
• Tact time can be reduced

Independent Control (181453)
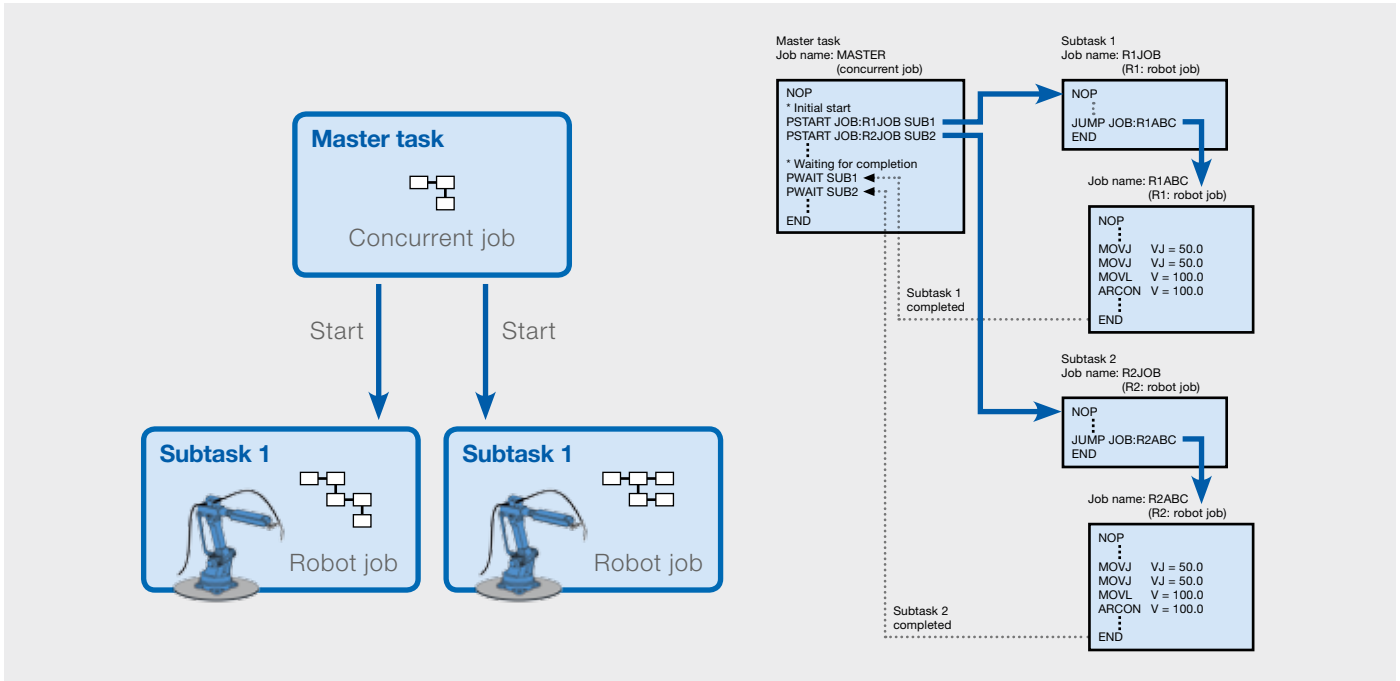
The controller can control a maximum of 8 robots and plural stations (jig) through one controller. The "Independent Control" function allows two robots or the robot and jig to operate independently with different programs.

The controller has a function for decoding and executing a maximum of 8 jobs (extendable up to 16 jobs (optional) individually. The multitask control performed in this function is called independent control.

For instance, a two-robot system can be constructed that consists of one welding robot welding the work piece and the other robot transferring unwelded work pieces and welded work pieces.

The system can be freely combined with applications for arc and non arc application. The teachbox key sheets are available on the basis of the master application.

Also, independent operation of the robot and station (external jig) can be performed. As an external axis motor, however, the motor for YASKAWA robot must be used.

KEY BENEFITS

- Multitask of 8 jobs (extendable up to 16 jobs) individually
- Maximum of 8 robots and plural station through one controller
- Freely combined with applications

Password Protection (181474)
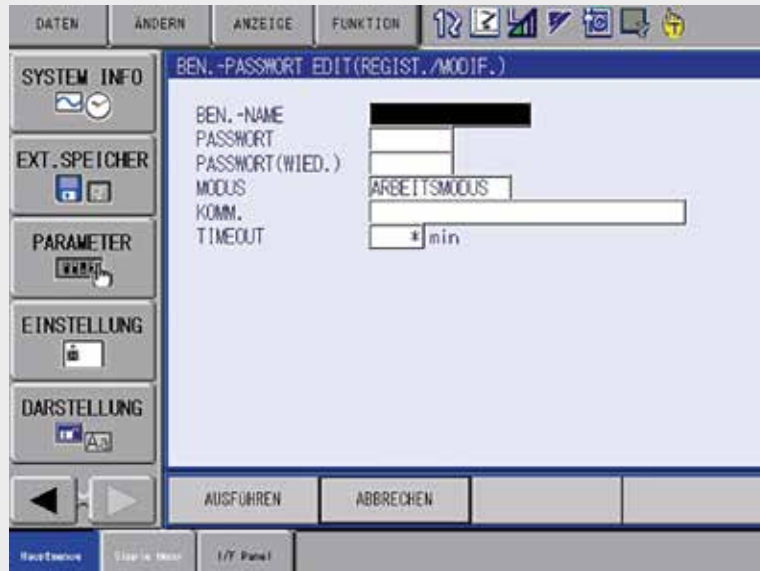
The "Password Protection" function helps assure system safety by requiring each user to have a personal authorization registered to access the controller so as to control what operations may be performed by the users.

The system administrator authorizes each user by assigning a login name and password, a security level and a timeout setting, thereby allowing a specific level of controller access.

The administrator can register up to 100 user accounts. The user account information can be stored in a file (USRINFO. DAT).

Only the system administrator can change registered user account information.

The "Password Protection" function also enables to find out, by tracing the alarm history, which user has been logged in at the time of a particular alarm.

KEY BENEFITS

• 100 user accounts
• Alarms with username
• Logbook function with username

Arm Interference with Specified Cubic Area Check (181478)
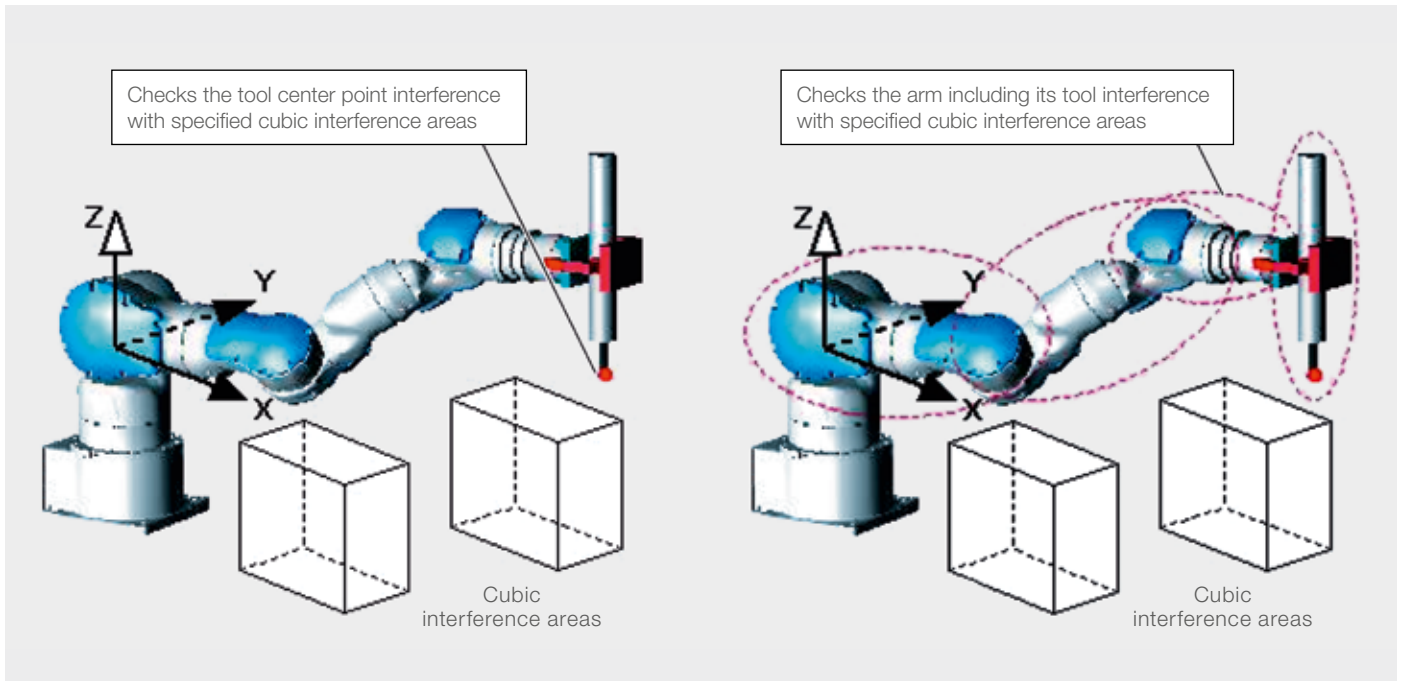
Checks the tool center point interference with specified cubic interference areas

Checks the arm including its tool interference with specified cubic interference areas

Cubic interference areas

Cubic interference areas

This function turns ON the corresponding system output signals "CUBE INTERFERENCE Signal" when the tool center point interfered with specified cubic areas.

On the other hand, this function turns ON the corresponding system output signals "CUBE INTERFERENCE Signal" when the manipulator's arm including its tool center point interfered with specified cubic areas.

Up to 8 areas can be registered as interference areas to the arm.

Alarm occurs and the manipulator stops immediately when the robot arm including the tool center point interferes with the already specified cubic interference areas.

The manipulator's tool part shape must be registered by the customer because its tool shape varies depending on the work that the manipulator performs. The shape can be registered with TOOL INTERFERE file. Function "Arm interference check" must be activated.

KEY BENEFITS

• This function can prevent collisions between robots/tools and cubics

Pendant Oscilloscope (181480)

Waveform display area

Condition setting panel

The "Pendant Oscilloscope" function is a monitoring function for visualizing the speed and torque of each robot axis and the status of concurrent IO signals on the Programming Pendant. The "Pendant Oscilloscope" is configured by a user interface, which requires no additional hardware components. Equipped with an integral display screen containing the waveform display window and the condition setting panel, the PP oscilloscope application enables to perform several processes from condition setting to measurement operations at the same time.

THE FOLLOWING FEATURES ARE INCLUDED

- Channel selective triggering and trigger level adjustment
- Cursor measurement function, for measuring certain distances in waveforms or between peaks after the data acquisition
- Zoom function for displaying the data in a magnified view
- Manual and auto saving mode for storing the data in CSV format
- Time scale adjustment

KEY BENEFITS

- No external oscilloscope is needed
- The servo conditions can easily be monitored and recorded
- Simple configuration of all relevant measuring parameters
- Data can be logged in a CSV file for easy analysis on PC

Analog Output corresponding to Speed (181486)

Speed: slow
Discharged
   amount: small

Speed: fast
Discharged amount: large

Analog voltage

14 V

Basic
voltage

Offset
voltage

0   Basic speed
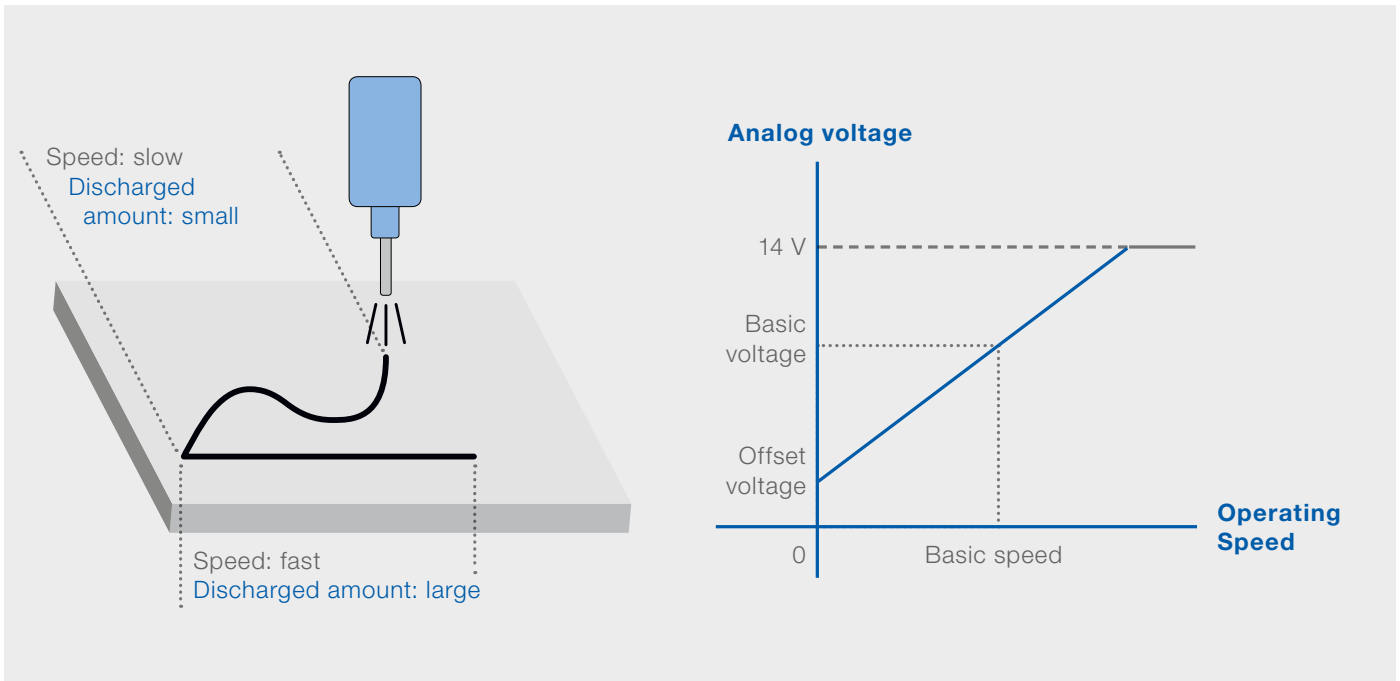
Operating
Speed

The "Analog Output corresponding to Speed" function auto-matically changes the analog output value depending on the variation of the manipulator operating speed. This function eliminates the need for setting the analog output value again depending on the variation of the operating speed, which reduces the teaching work for the job.

This function is useful when the thickness of sealing or paint-ing should be constant, the manipulator operating speed can control the discharged amount of seals or paints.

According to the set value of the ARATION instruction, the output characteristics for the relation between the operating speed and the analog voltage are calculated. The "Analog Output Function corresponding to Speed" is executed depending on these output characteristics.

When the ARATIOF instruction is executed, the analog out-put corresponding to speed is completed, and the set offset voltage becomes the fixed output.

KEY BENEFITS

- Teaching effort is reduced
- Output possibilities: Analog (additional analog output extension board required) and/or digital 16-bit signal
- By using a filter process, the output signal can be close to the manipulator's actual speed

Vision Function (181515)
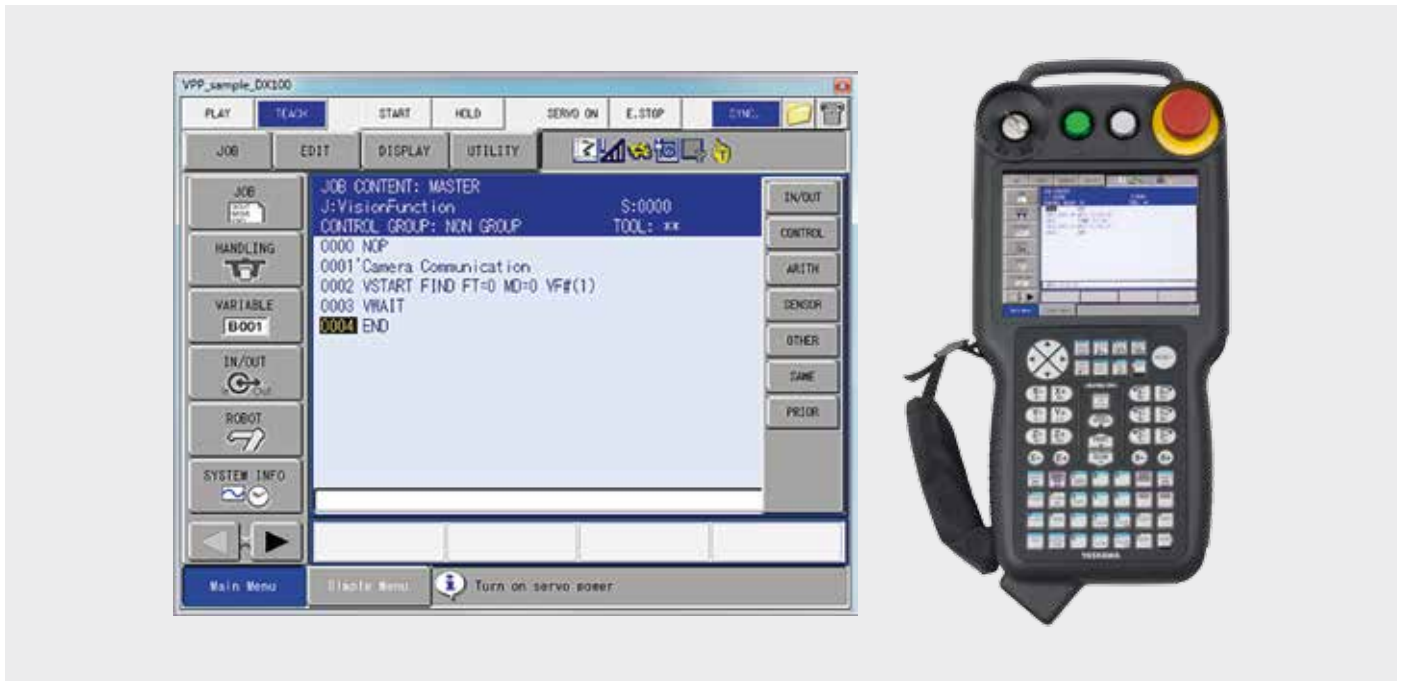
This function is an inform instruction to communicate with different Vision System. It maps the communication protocols of a variety of selected vision systems and works, dependent on these, on the basis of Ethernet or RS232. This robot instruction allows easy control of image processing devices.

MAIN FUNCTIONS

- In practice, this instruction is used to trigger a camera and including to receive any results data (e.g. position of a recognized part) without additional hardware

KEY BENEFITS

- Based on inform language ("VSTART" and "VWAIT") by communication
- No additional hardware required. Communication is done using the standard Ethernet or RS232 port of the controller
- Vision function support the following manufacturer with below described model:
  OMRON model: F160, F210, F250, via RS232-C FZ2, FZ3, FZ3 series Ethernet or RS232-C, Cam. No.: 1 to 4
  COGNEX model: In-sight and In-Sight Micro series via Ethernet, Cam. No.: 1
  KEYENCE model: CV-3000/5000 and XG-7000 series, Ethernet, Cam. No.: 1, Interface: Ethernet, Cam. No.: 1
- Camera Jobs must be create with additional software on camera side (e.g. for Cognex "In-Sight Explorer" on Pc).

REQUIRED FUNCTIONS

- YRC1000 Ethernet function

Configuration Parameter (181483)
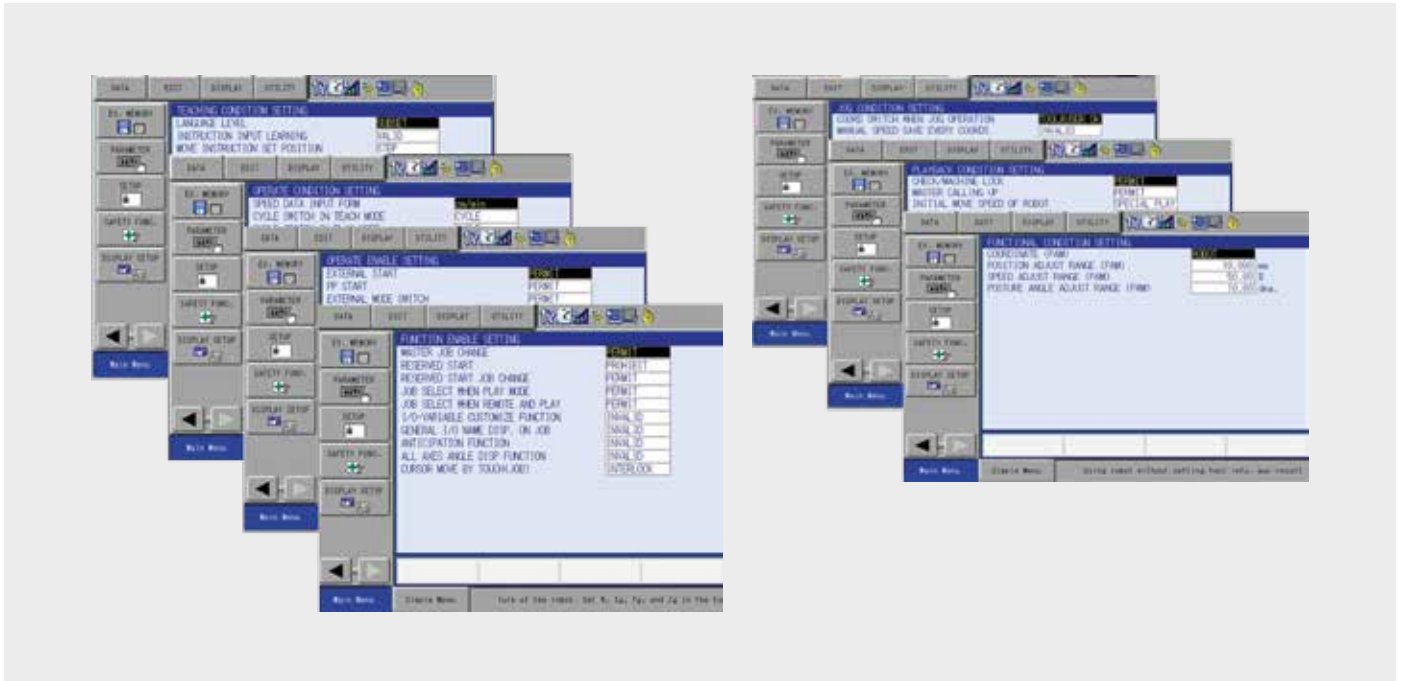
- Recommended standard settings
- YASKAWA standard system configuration
  e.g. The behavior of programming pendant, setup menu
  settings, comfort settings, etc.
- These settings can be adjusted by the customer in the
  controller itself

KEY BENEFITS

- Recommended standard settings
- Customized configuration

Ethernet Standard GSI (181517)
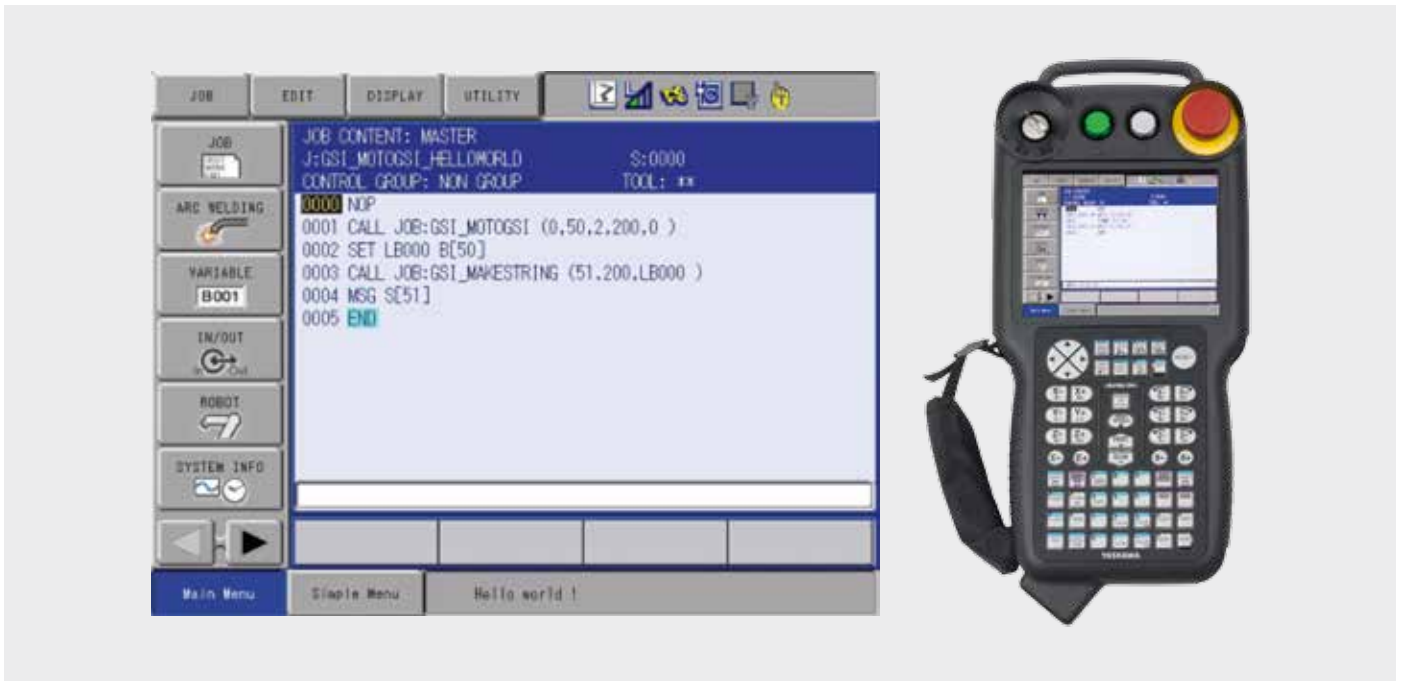
MotoGSI extends the communication capabilities of YRC1000 controller by adding general socket communication instructions to the INFORM language, which makes it possible for the standard robot programmer to solve a wide range of communication tasks.

MAIN FUNCTIONS

- Extends the INFORM language by socket communication functions based on Ethernet/TCP, Ethernet/UDP or RS232
- No additional hardware required. Communication is done using the standard Ethernet or RS232 port of the controller
- Communication with nearly every external device that supports on Ethernet/TCP, Ethernet/UDP or RS232
- Additional PP App for debugging GSI jobs

KEY BENEFITS

- Extends the INFORM Language
- Implementing of specific protocols based on Ethernet/TCP, Ethernet/UDP or RS232
- Set of helper functions to process and convert datastreams
- Pattern based search in the input datastream
- Easy to integrate in own inform jobs
- Based on MotoPlus

MotoModbus (181518)

With "MOTOModbus", YASKAWA opens up a standard interface to almost any HMI (Human-Machine Interface = connection/hardware between human and machine).

The adjustable interface can transfer variables and information via inputs/outputs. This allows easy, direct communication between the robot controller YRC1000 and any HMI with a suitable Modbus TCP client interface. Additional field bus hardware is not necessary.

KEY BENEFITS

- Reading and writing of variables
- Reading and writing of IOs
- Direct communication between robot controller and HMI on the basis of Modbus/Ethernet

SCOPE OF SUPPLY

- CD-ROM

SYSTEM REQUIREMENTS PC

- YRC1000

Search Function – Soft Stop (181455)
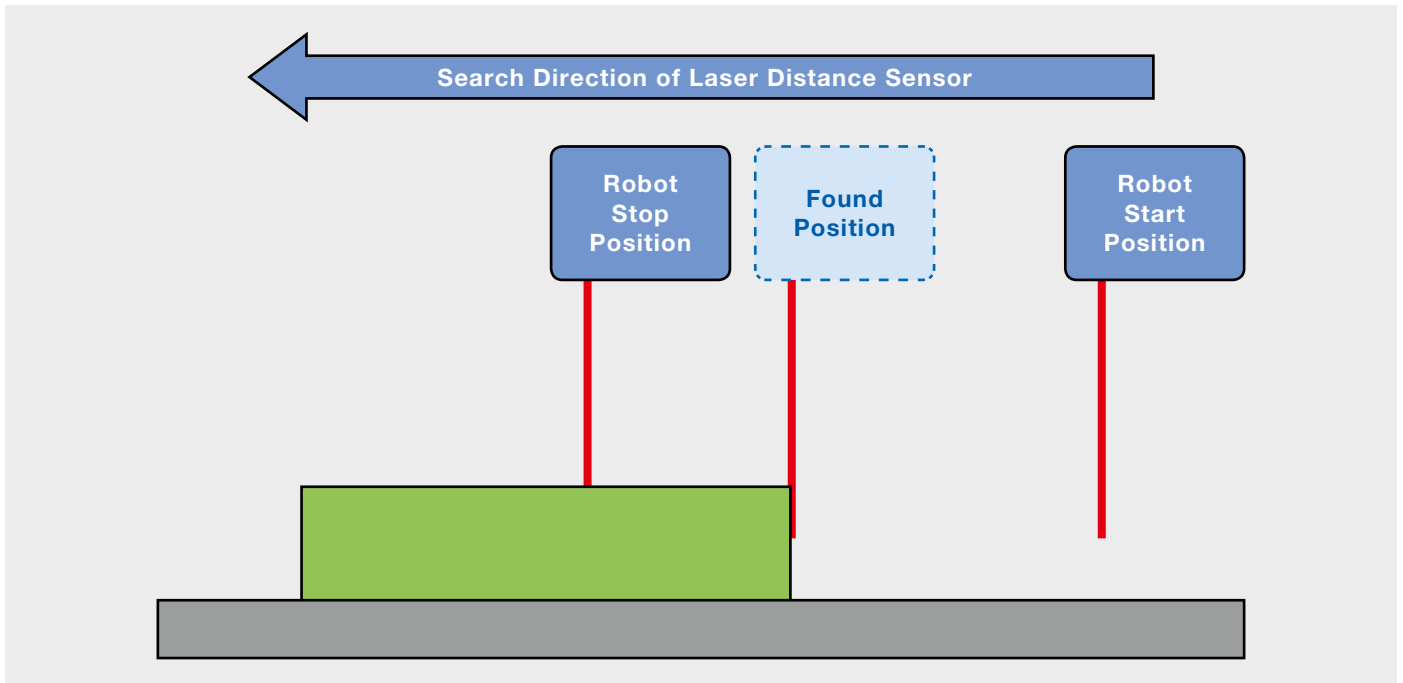
The "Search Function – Soft Stop" uses various general detection sensors to stop the robot by detection signal of the sensor and to allow the robot to operate the next working steps, so this function searches the target to be worked on.
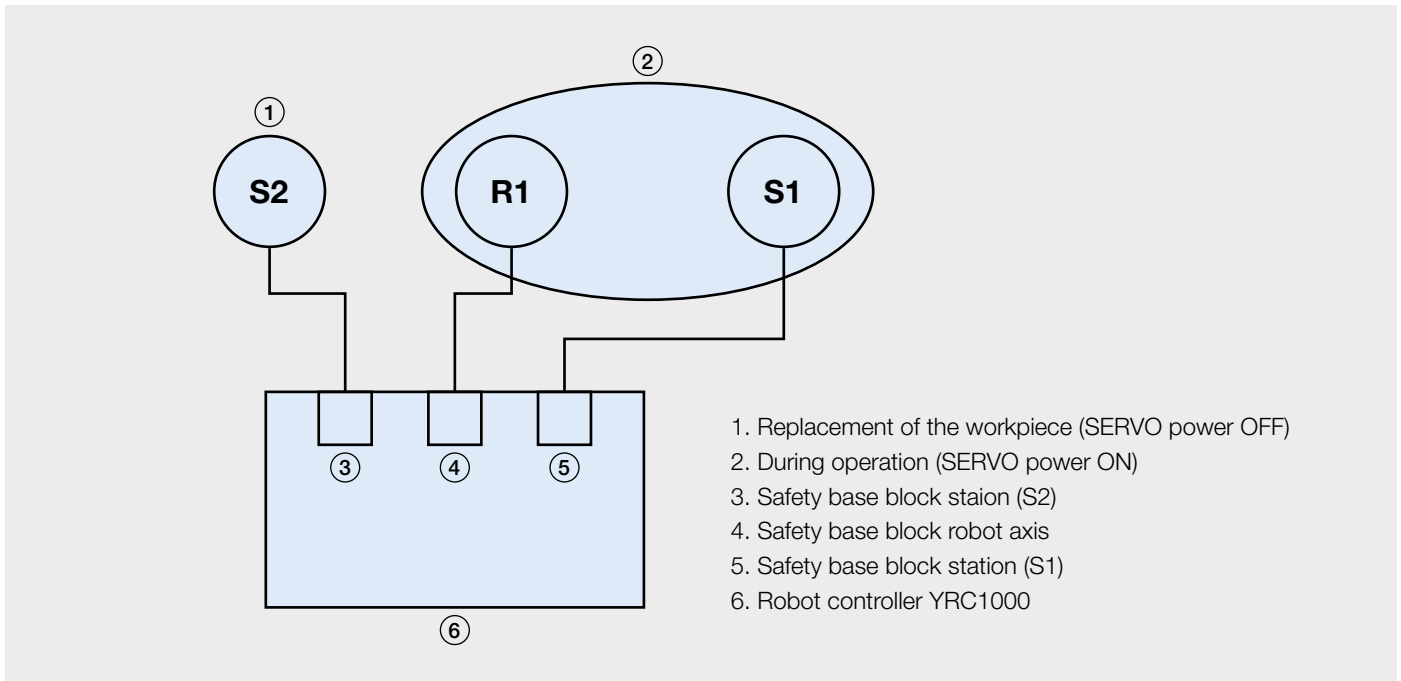
If the robot detects a sensor signal, the controller stores the found position and the robot stops the movement with deceleration (soft stop).

High speed searching with contactless sensors is possible.

KEY BENEFITS

- Robot stops the movement with deceleration
- High speed searching
- Save speed reducer lifetime
- Applicable for searching the height of stacks

IO JOG Operation in Play-mode (181463)
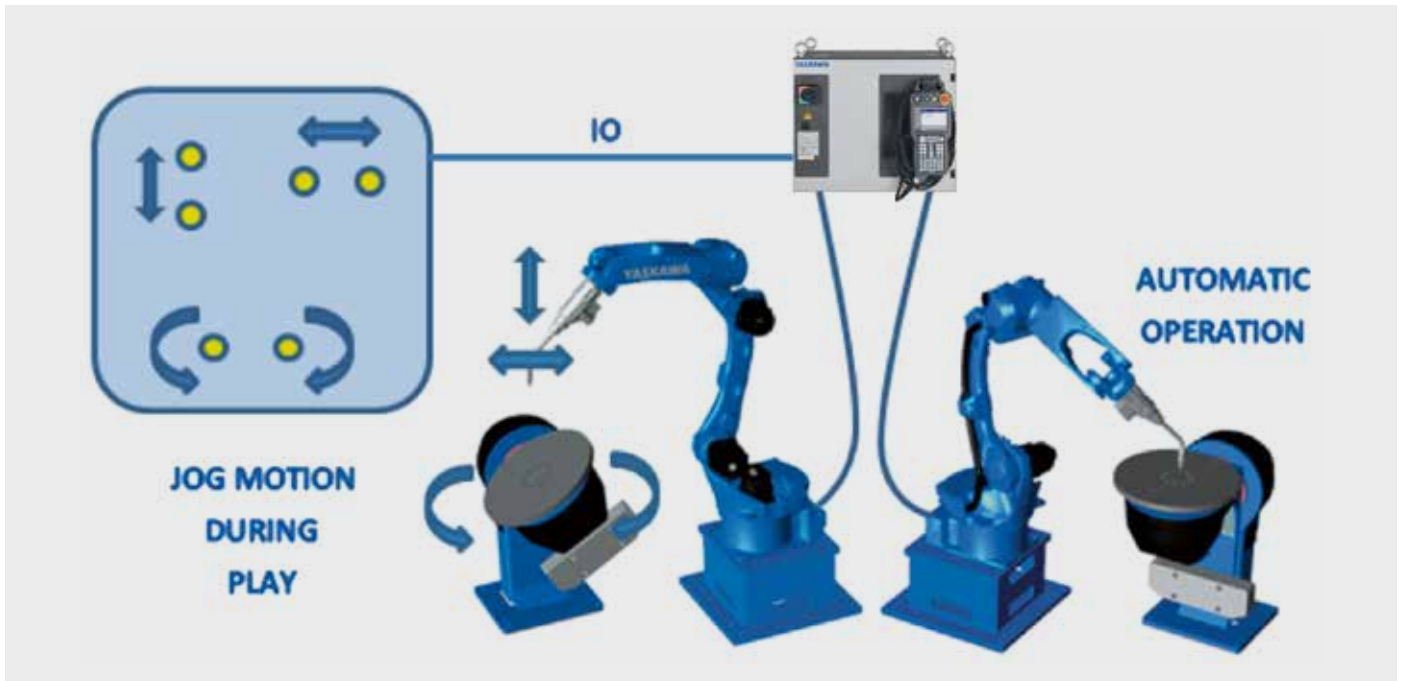
The "IO JOG Operation in Play-Mode" function performs axis operation for robot and external axes using universal input signals instead of the programming pendant.

Axis operation (JOG Operation) of a robot or station control group that is not registered in the job in playback operation can be executed using the allocated general-purpose input signals.

General-purpose inputs are also used to select the motion velocity. Five levels or individual speeds are possible.

In the event of a call or jump to a job that includes the station that is active in the current IO JOG operation, an alarm is triggered to stop operation of the robot and the station.

We recommend connecting each robot or station to a power-on unit. It is also advisable to turn off the servo for the control group that is not in operation.

KEY BENEFITS

- Robot or external axes can be moved without stopping the production line
- This function makes it possible to operate currently unused robots and external axes, check the quality of a workpiece or perform additional preparatory work on it
- "IO JOG Operation in Play Mode" software is necessary
- This function cannot be used with Twin-Drive stations

Search Function – Hard Stop (181468)

Search Direction of Tactile Sensor

Robot Start Position

Robot Start Position

Wire Search
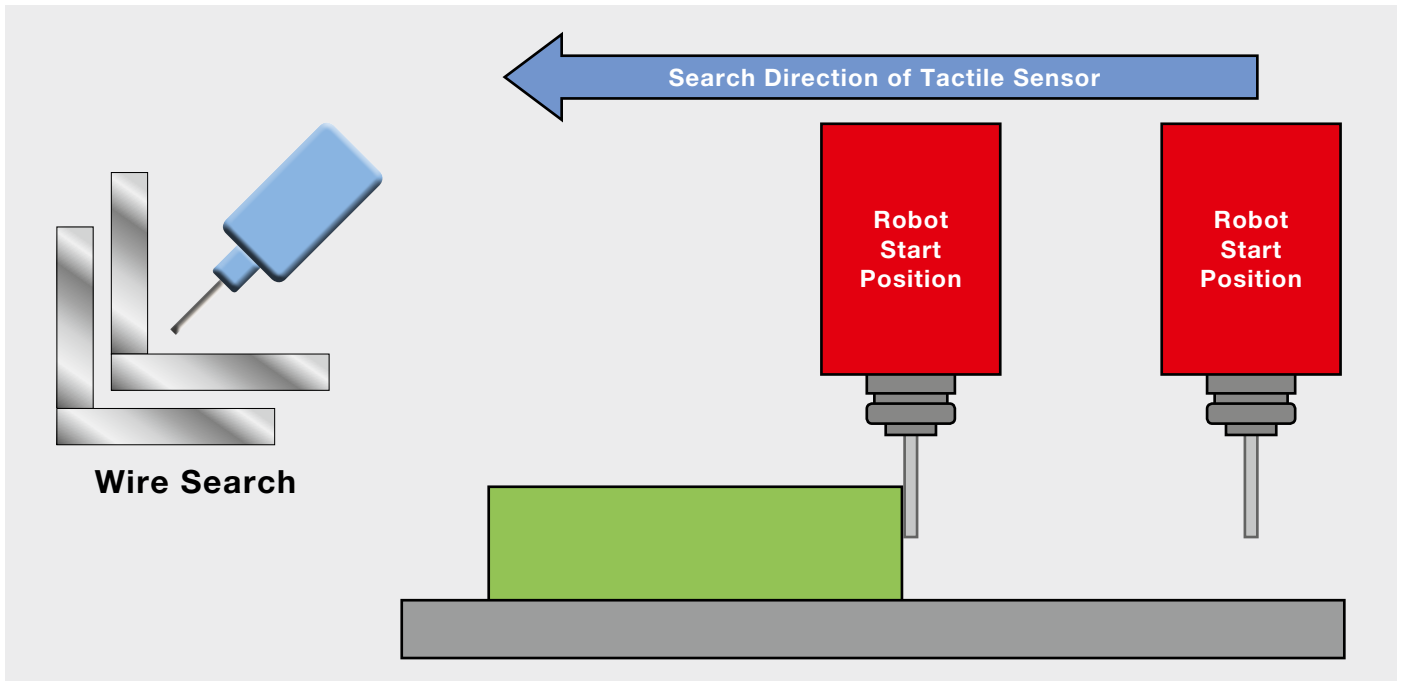
The "Search Function – Hard Stop" uses various general detection sensors to stop the robot by detection signal of the sensor and to allow the robot to operate the next work, so this function searches the target to be worked on.

If robot detects a sensor signal, the controller stores found position and the robot stops the movement immediately (hard stop).

Low speed searching with touch sensors is possible.

KEY BENEFITS

- Robot stops the movement immediately
- Low speed searching
- Applicable for searching workpieces with welding wire or tactile sensors
- Applicable to measure the diameter of grinding wheels

Individual STO (Servo Torque Off) **(182765)**

1. Replacement of the workpiece (SERVO power OFF)
2. During operation (SERVO power ON)
3. Safety base block staion (S2)
4. Safety base block robot axis
5. Safety base block station (S1)
6. Robot controller YRC1000

The "Individual STO (Servo Torque Off)" function is to turn ON/OFF the servo power supply in units of specified control group freely in the robot system with multiple control group configuration. Using this function, without stopping whole the system operation, the servo power supply only for the control group selected by an operator can be turned OFF. Therefore, the safe operation for removing a work piece with the system running and maintenance for robot tool, is secured, moreover, the operating efficiency is increased.

The "STO" function based on the station and robot declaration. It will be switch off complete stations and/or robots (including Base).

This function has performance level d (PLd).

KEY BENEFITS

• Safe switch off of robot and/or stations
• Safe signals (redundant signals)
• Performance level d

Master Tool User Frame (182768)

Master Tool
Frame (MTF)

User Frame
based on MTF

Jigless System

Master Tool
Frame (MTF)

User Frame
based on MTF

Coordinated System with 2 Stations
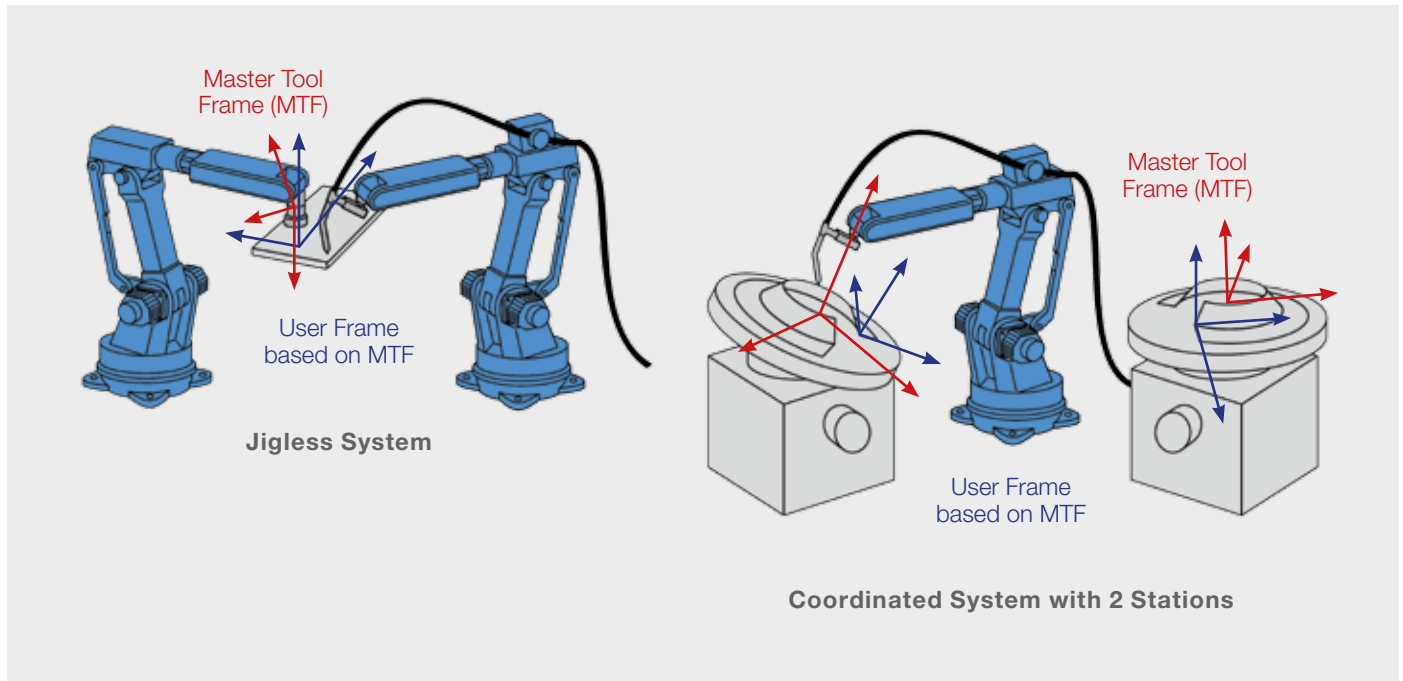
The "Master Tool User Frame" is a special function for jigless systems and coordinated motion systems.

Master Tools are tool coordinated points at jigless systems or calibrations between robots and stations.

During motion of robots and stations Master Tools move in space. Shift values or relative coordinates can hardly be calculated.

By default, user coordinate systems are fixed in space. This feature allows the definition of user coordinate systems based on Master Tools.

Simple calculation of coordinates and shift values based on "Master Tool User Frames".

The devices of two stations do not have to be identical. Relative jobs based on "Master Tool User Frames" can be easily transferred.

KEY BENEFITS

• Easy shift of points or jobs
• Easy handling with relative jobs based on user frames
• Simple job transfer between different stations
  or robot systems
• Available for jigless systems and coordinated systems
  with stations

Sensor Function (181492)

Example for path correction

Shifted tool center point

Tracking path

Offset amount (0, -L, 0)

Shifted tool center point

x

y

z

Tool center point without offset

Tool frame

Welding line data

System configuration example for search function

Search starting position

Panel

Direct IN signal

Displacement sensor

Stocker

Position data of a, b, c

External calculator, Vision controller, etc.

Camera

Z

Y

X

System configuration example for shift value creation function

The "Sensor" function corrects the robot path and velocity in up to three directions, measures the distance, and detects the position using an analog displacement sensor, an analog torque sensor and other analog sensors.

Real-time path correction according to the sensor signal in playback operation:
With this function, a sensor can detect the deformation and positional deviation of the workpiece and the robot can correct the path in real time. Furthermore, this function monitors whether the sensor signal exceeds the upper or lower limit of the threshold value to prevent the robot from dramatically deviating from the path.

Real-time velocity correction according to the sensor signal:
The robot normally moves at the velocity set for the job. If the operating time varies depending on individual workpiece differences, this function allows detection of the state of progress of operation and enables the robot to operate at an appropriate velocity.

Offset value creation function according to the sensor signal:
The distance to the target workpiece can be calculated using the input signal from the displacement sensor, and the robot job can then be offset in accordance with that measurement.

KEY BENEFITS

- Fully automatic compensation of workpiece tolerances in playback operation
- Velocity correction according to an analog signal
- Offset value creation according to an analog signal
- Search function according to an analog signal

Standard (Conveyor Synchronized) (182769)
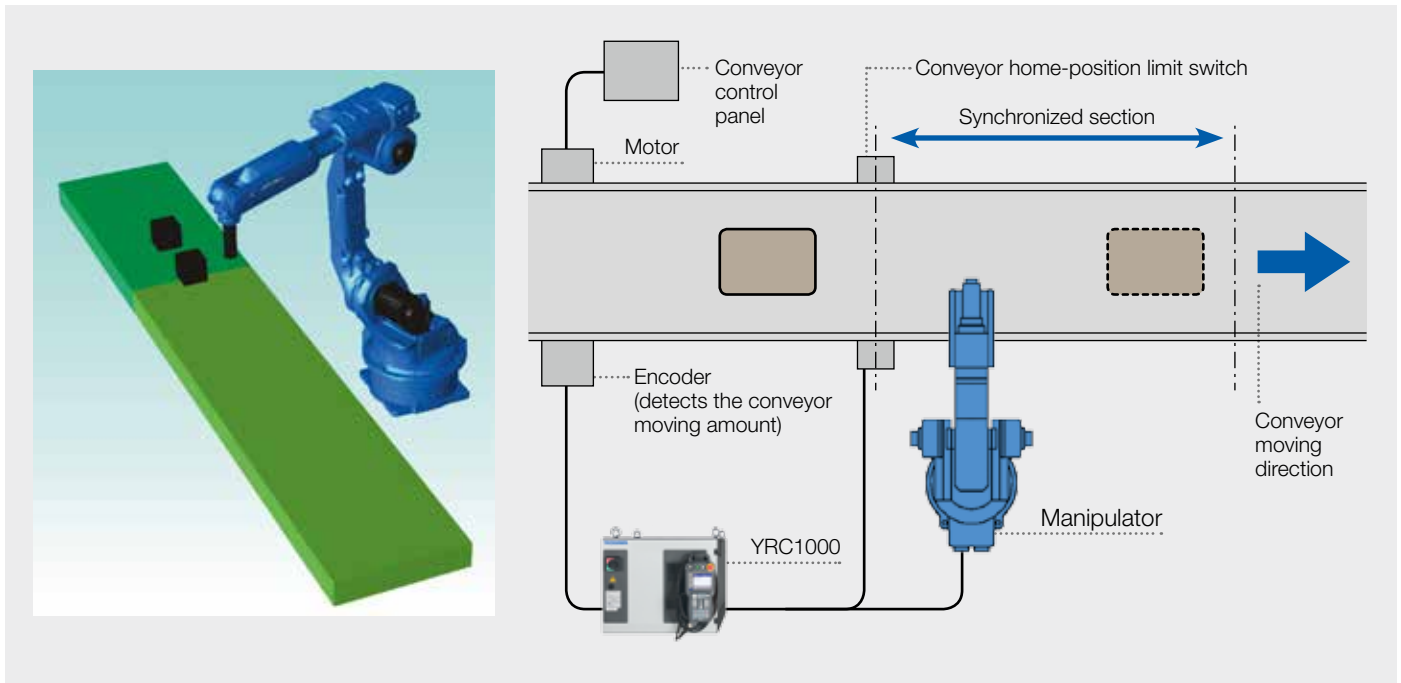
"Conveyor Synchronized" means that the manipulator operations are synchronized with the conveyor.

The manipulator works at the workpiece while the conveyor is moving.

There are three types of conveyor tracking motion: robot-axis tracking, base-axis tracking, and circular tracking.

Conveyor tracking function uses the travel distance of the conveyor. This means that the velocity of the manipulator relative to the workpiece is always constant.

KEY BENEFITS

- Robot operations are synchronized with the conveyor
- The velocity of the robot relative to the workpiece is always constant
- The conveyor tracking function can process a single workpiece from the input of the limit switch signal through to the robot tracking operation

Conveyor Synchronized with Shift (182770)
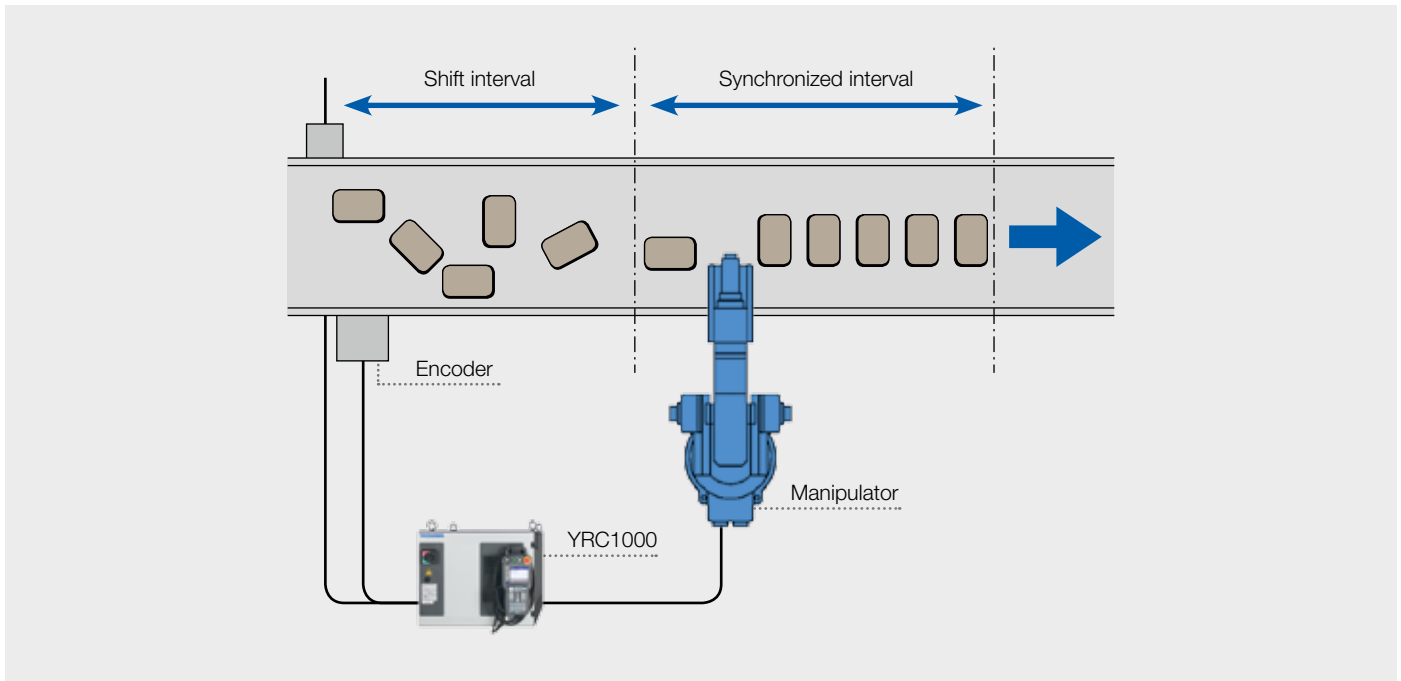
The "Conveyor Synchronized with Shift" function temporally stores information on multiple work pieces to enable the tracking process depending on each work piece.

This function is used when a large number of work pieces simultaneously flow between the limit switch and the manipulator.

Example:
When a part reaches the STP (start position) the robot starts the synchronization. If another part reaches the STP, the robot will first finish the running Job at the current part. Then the robot returns to the home position and starts the synchronization at the second part while it is located within the OL (over limit) range.
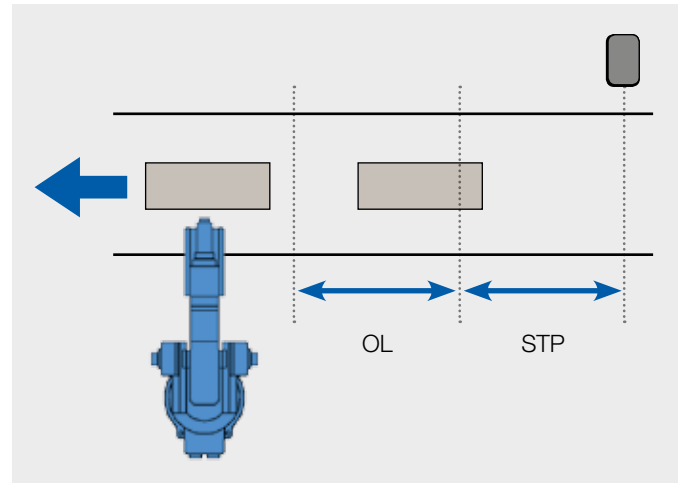
KEY BENEFITS

- Robot operations are synchronized with the conveyor
- The function can be applied to linear conveyor, circular conveyor, and revolving table
- The function can also be applied to the case where plural work pieces flow within the shift interval (a maximum of 99 pieces)

IO Speed Control (181498)

Set the universal input signal number to perform the rotation instruction.

For specifying the rotation speed, select from the following methods:
– DIRECT
   Specify the rotation speed between – 32,768 to 32,767 rpm with using 2 groups of universal input signal.
– LEVEL
   Select from 8-level rotation speeds by the signal conditions. Each rotation speed of 8 levels can be specified by the setting file respectively.

This is a function which performs the speed control operation of the external axis with using user input signals.

The external axis can be continuously rotated according to the specified settings.

Without executing the speed control command by a job, the speed control operation of the external axis can be operated by inputting an external signal. It can be used for controlling the pump axis mainly used for painting.

KEY BENEFITS

• Teaching time can be reduced
• Tact time can be reduced
• Working efficiency can be improved
• The speed control axis rotates at the specified speed by IO signals

External Axis Endless (181491)
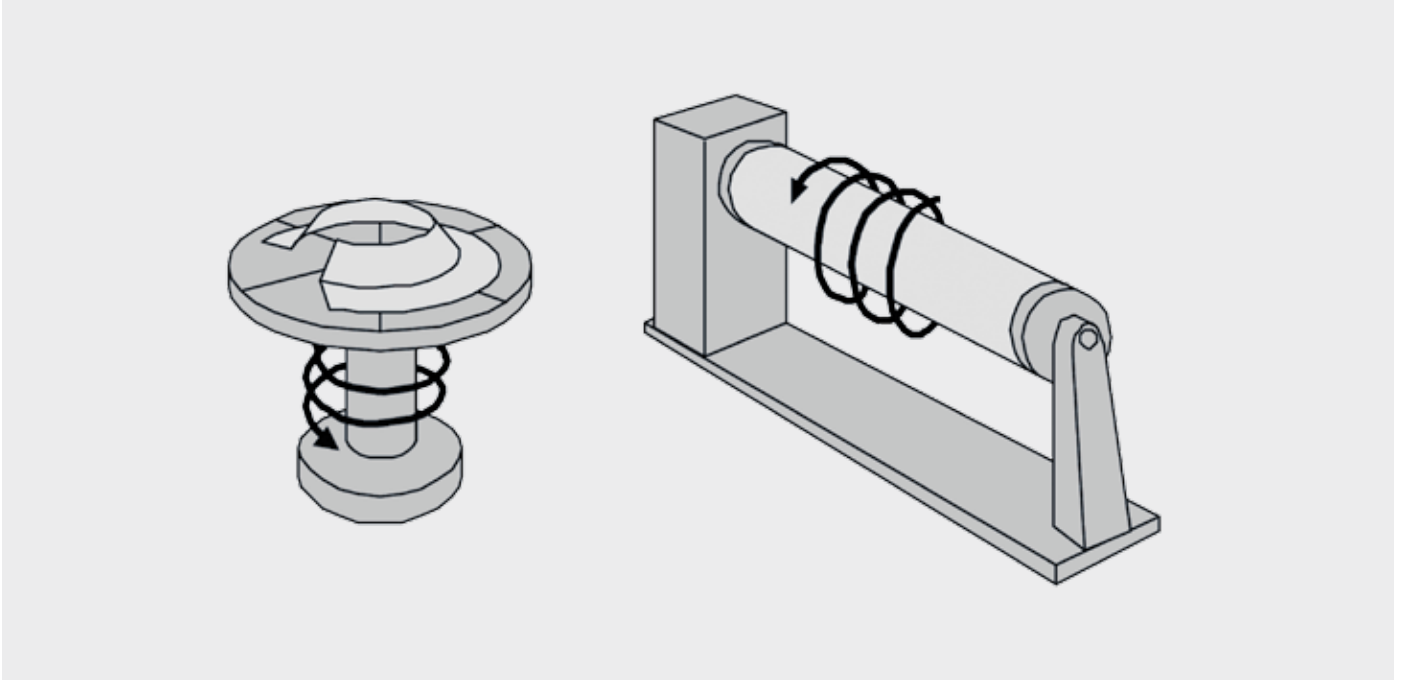
This function continuously rotates the external axis a plural number of turns. Although the rotation angle of the external axis is generally limited within ±360 degrees, this function allows it to rotate endlessly. When executing the move instruction MOVJ with the "number of rotations of the external axis" specified, the external axis rotates the "specified rotating amount + teaching position pulses" during the movement to the target position. One move command can specify up to ±100 turns.

KEY BENEFITS

• Teaching time can be reduced
• Tact time can be reduced

Group Change (181493)
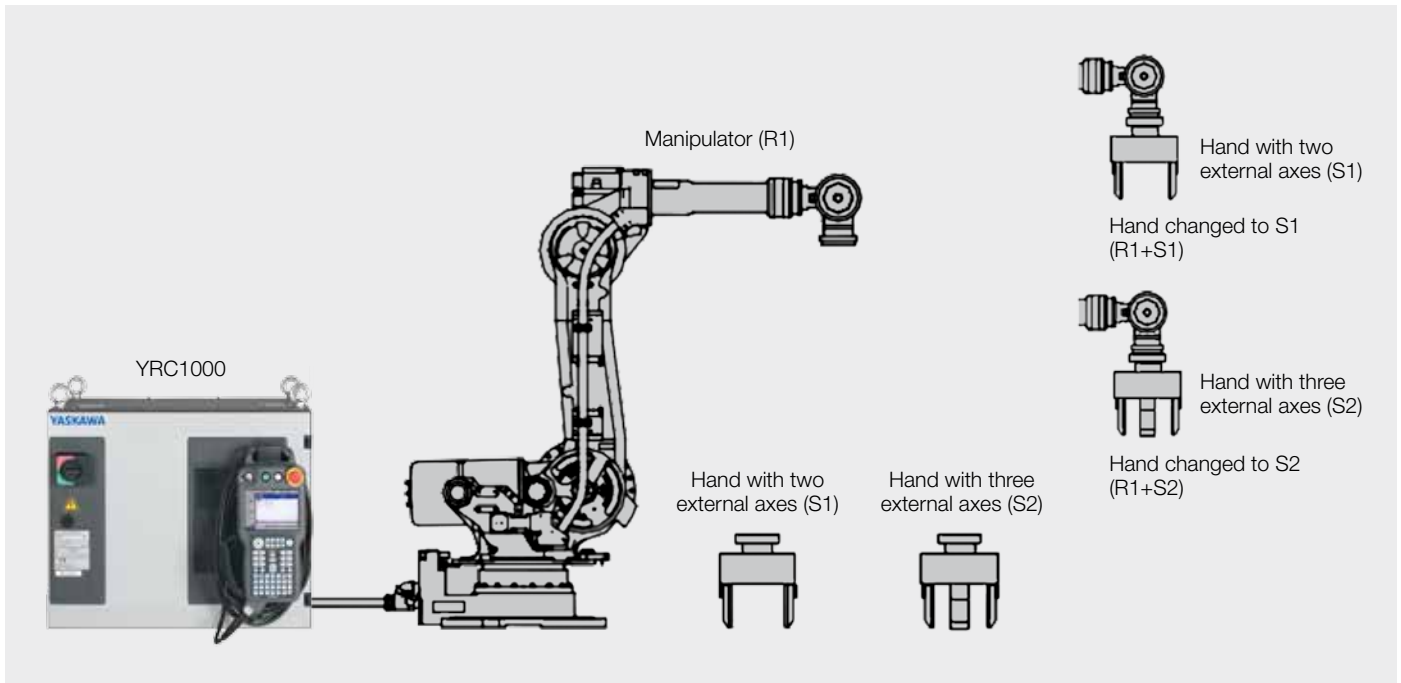
The "Group Change" function attaches/detaches a tool with multiple external axes. This function changes with the special instructions (CHUCK/UNCHUCK) more than one tool (such as gripper) with external axes. Using a robot with more than one tool this function allows individual tasks with various types of work pieces. The group change function improves work efficiency. In combination with ATC (Auto Tool Changer), the tool can be quickly changed by one instruction ("GRPCHG" instruction).

KEY BENEFITS

- Various tasks using one robot
- Improved work efficiency
- Quick change for tools by external axes

Station Twin/Triple/Quad (182772)

2-unit (twin) coordination	3-unit (triple) coordination
R1 R2 — Station S1	R1 R2 R3 — Station S1

4-unit (quad) coordination
R1 R2 R3 R4 — Station S1

Robot 1
Robot 2
Station
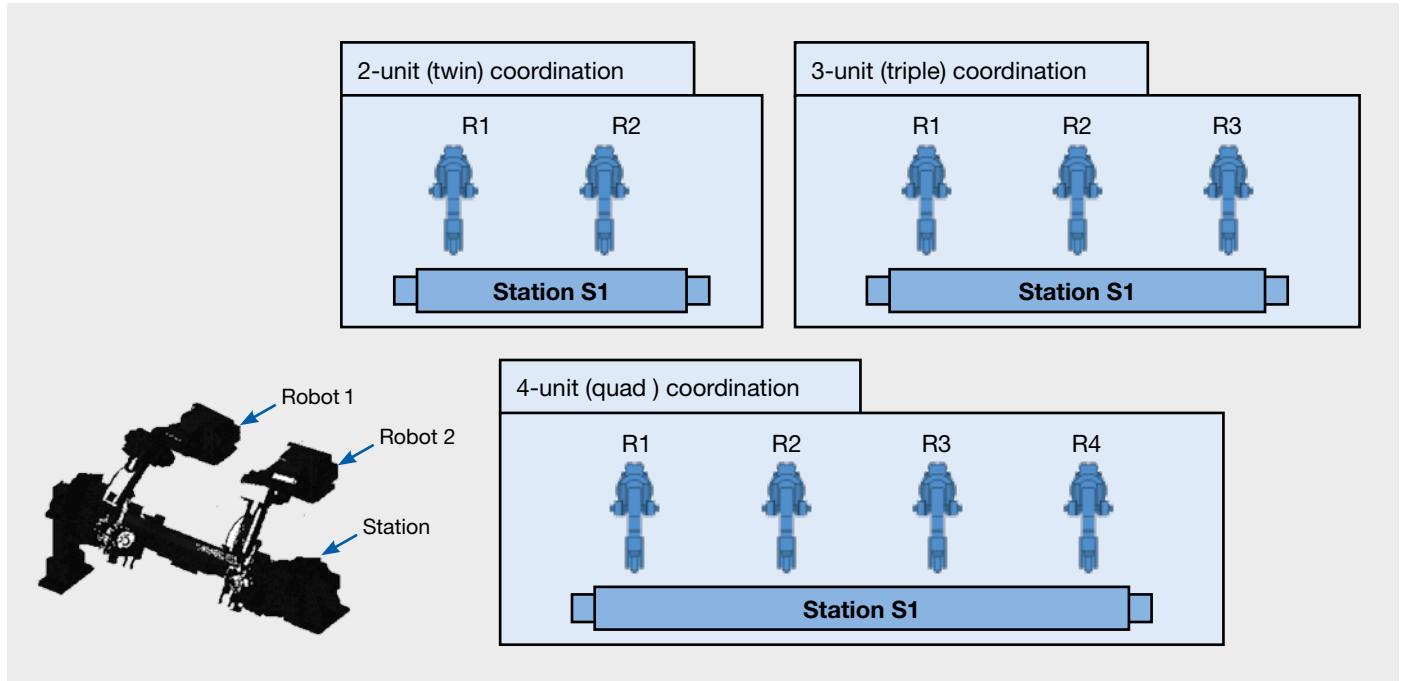
The "Station Twin/Triple/Quad" function is used for systems where 2-unit (twin), 3-unit (triple), or 4-unit (quad) manipulators perform in coordination with one station.

This function enables two or more robots to simultaneously control the interpolation operation and relative speed that are relative to one station (rotation axis).

This function is suitable for applications such as welding the right and left ends of a lengthy work piece.

Synchronization instruction

```
NOP
PSTART SUB1
PSTART SUB2 (SYNC) SUB1
PWAIT SUB1
PWAIT SUB2
ENG
```

```
R1+S1:S1
NOP
SMOL V=60
SMOL V=60
END
```

```
R2+S1:S1
NOP
SMOL V=60
SMOL V=60
END
```
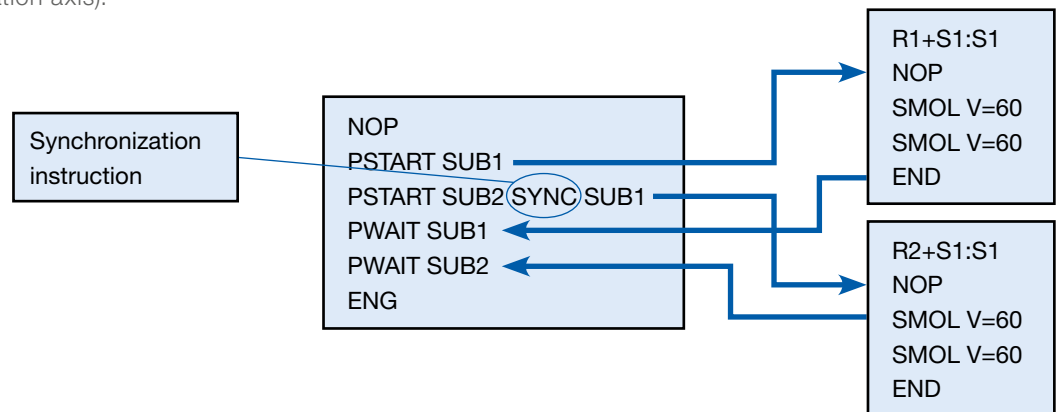
KEY BENEFITS

- Improved welding quality + reduced cycle time when changing jig posture (for welding)
- Reduced teaching time
- Reduced effort for wiring and IO check
- Easy security for teaching two or more robots
- Capable of smartly constructing program using coordinated/independent functions

Twin Drive (182775)

2nd station axis 1st station axis **TWIN-2**

3rd station axis 2nd station axis 1st station axis **TWIN-3A**

2nd station axis 3rd station axis 1st station axis **TWIN-3B**
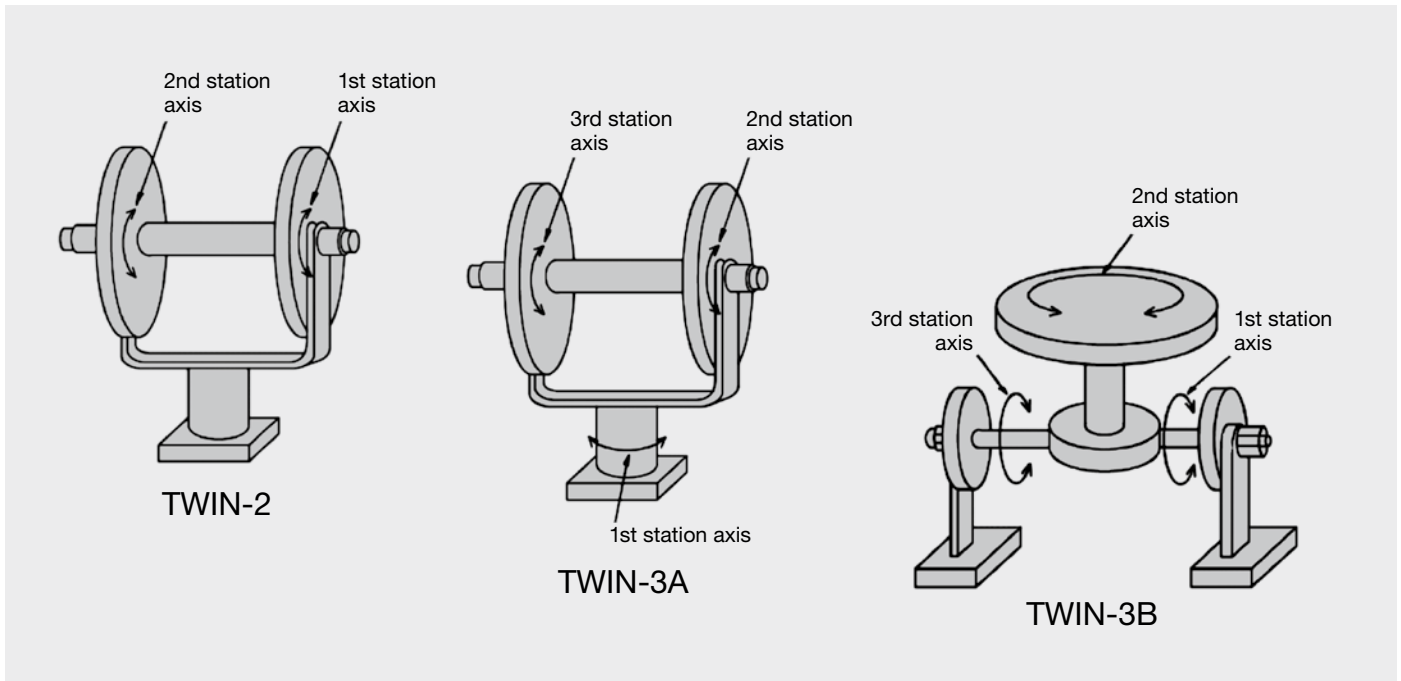
If an axis with a large load is controlled by one motor in configuring station axes for welding applications or others, a large-capacity motor must be selected because of lack of motor capacity and torque. In that case, the station axis becomes large, which may cause a problem in installation space.

Where by, the axis with a large load may be controlled by two motors to compensate for lack of motor capacity and torque.

In such a system, however, two motors must be simultaneously operated.

The "Twin Drive" function enables the station sub-axis motor to operate simultaneously with the station main-axis motor during teaching in such a case where the station is operated by two motors.

Requirements:
1. The same motor is used for the twin drive configuration axis.
2. The mechanism specification and motor specification on station axes are set in the same condition.

Operation modes of station axis during teaching:
1. Simultaneous operation mode
2. Single operation mode

KEY BENEFITS

- Useful for heavy load positioners
- For long distances between head- and tailstock
- Space-saving installation:
  Large station axis can be controlled by two motors with relatively low capacity, system installation takes up less space

- Reduced teaching time:
  When selecting simultaneous operation mode during teaching, just pressing the control key for the main axis will simultaneously move the sub axis

Advanced Control Group (182776)

Advanced control group active
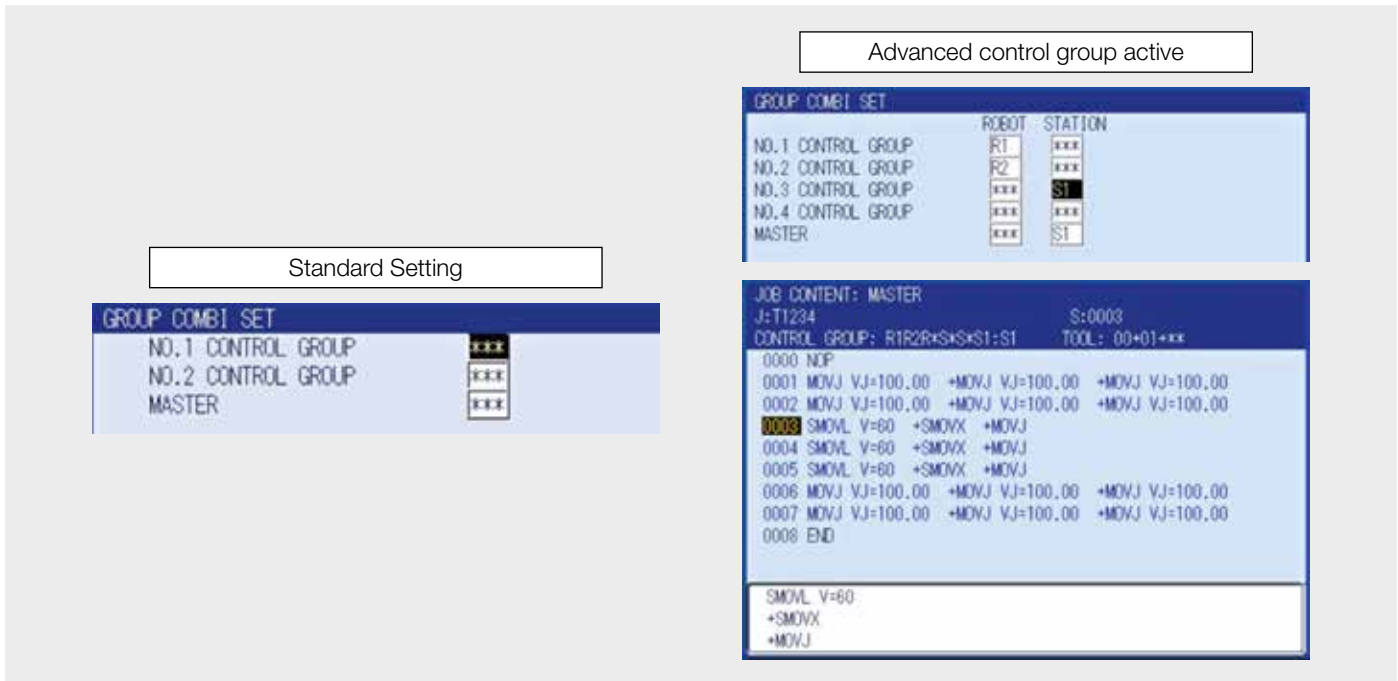
Standard Setting

In Standard Setting two group axes can be combined into one job. With this function up to 4 group axes can be combined into one job.
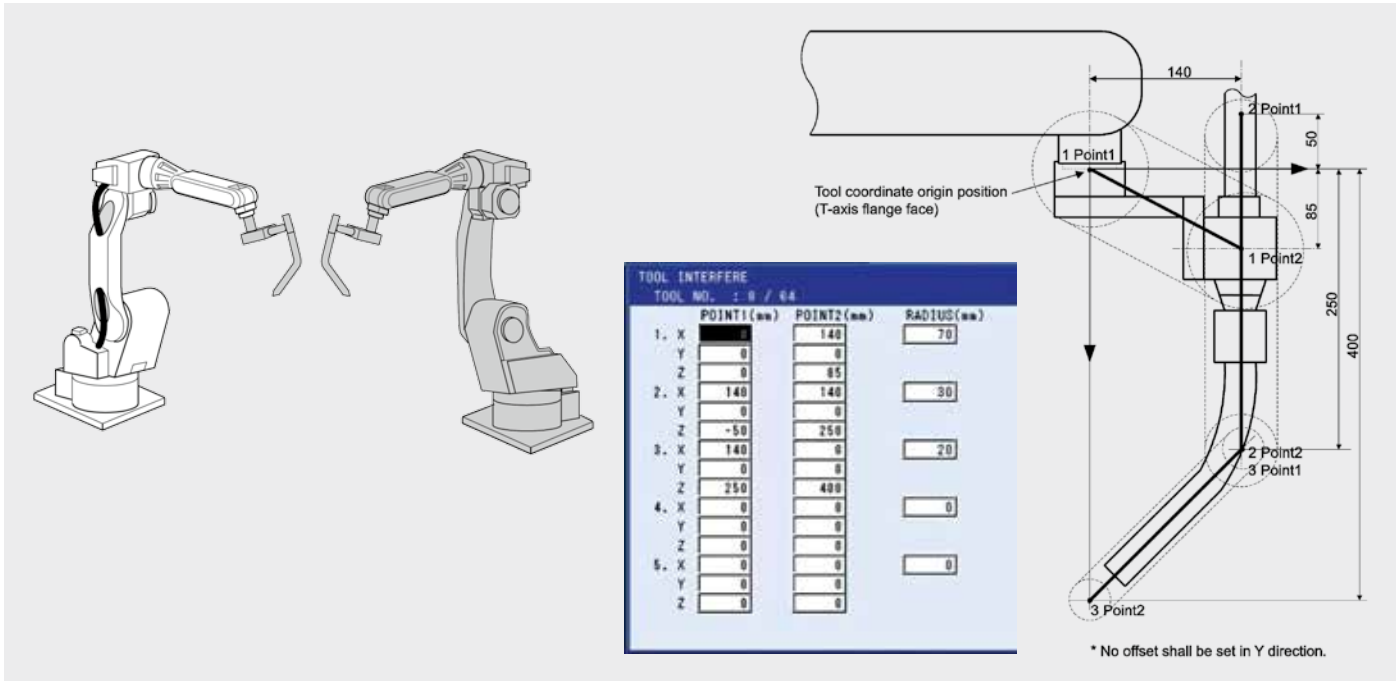
The "Advanced Control Group" function can be used to reduce parallel tasks (PSTART).

Axis group change in JOB HEADER is not possible.

KEY BENEFITS

• Reduce parallel task (PSTART)
• Simple job structures
• Simple job maintenance

Arm Interference Check (182766)

This function checks the interference among manipulator arms and tools in the system consisting of one controller and multiple manipulators.

Interference between each of the following is checked:
1. Arm and arm
2. Arm and tool
3. Tool and tool

The checking method is to approximate each axis arm and tool in cylinder and then the interference is checked between the approximated cylinders.

Spheres are set at both ends of the cylinder, and the interferences are checked between spheres and between sphere and cylinder.

If this cylinder or sphere is intersected, the manipulators stop.

The tool part must be set by the customer because the

tool shape depends on the work that the robot performs. These settings are set in the tool interfere file. A maximum of 5 cylinders and spheres can be set.

The "Arm Interfere Check" function requires setting of cylinder and sphere for the robot arm. These setting values need not be set by the customer because they are factory-set.

The "Arm Interfere Check" function may not be used depending on the robot type. All robots which are supported by FSU-Function are possible.

No check between tool and robot himself.

KEY BENEFITS

• Prevent collisions between robots and tools

Safety Re-teach (181482)
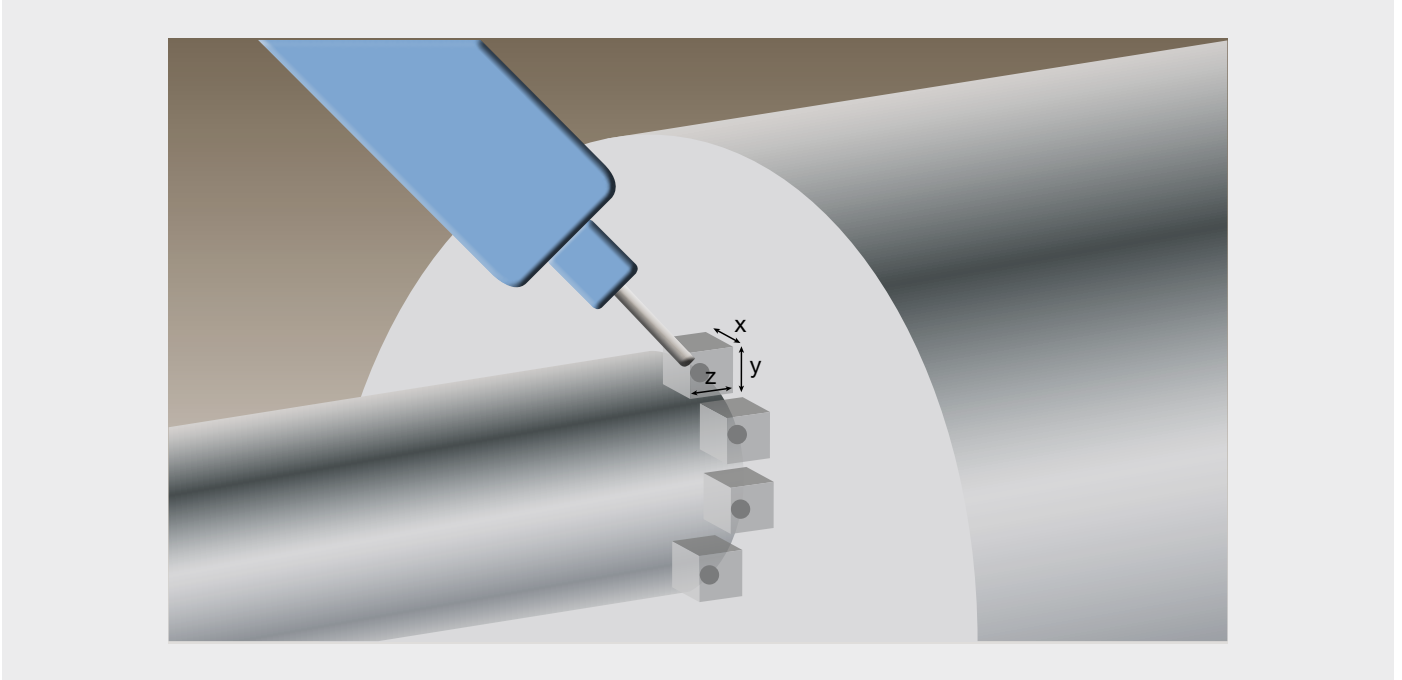
With this function the programmer can control the plant, the area in which the system operator can make some adjustment of the program.

KEY BENEFITS

- Quality improvement through rapid adaptation
- Re-teaching is already possible by the operator

Zeroing Sensor (181502)

Zeroing Equipment

Hint graphic:
Necessary hardware
for using function

Sensor ➝

Amplifier ⬅

USB for
programming
pendant ⬅

The "Zeroing Sensor" function enables fast and easy restoring to the home position (absolute data) of robots and/or external axes.

After replacing mechanical parts (for example: complete robot arm), new offset values can be determined. Menuguided measurements on the programming pendant are also possible.

Example:
Procedure after replacement of a servo motor
• Replacement of servo motor (home position is lost)
• Operate the manipulator/external axis to change its posture so that zeroing can be performed
• Install the zeroing unit to the manipulator/external axis
• Press the "Zeroing" button
  – Manipulator/external axis automatically operates
  – Detection and registry of home position are automatically performed
  – Remove the zeroing unit from the manipulator

KEY BENEFITS

• Minimizing machine downtimes
• Accurate home position can be restored in a short period of time while replacing motor or speed reducer
• Reduced time to restore the absolute data when they are lost

REQUIREMENTS

• The "Zeroing Sensor" cannot be used with every robot type
• External axis/positioners have to be prepared before using it with "Zeroing Sensor"
• Robot hardware has to be ordered separately for each robot
• Additional order of Zeroing equipment

Full-Speed Test (181500)
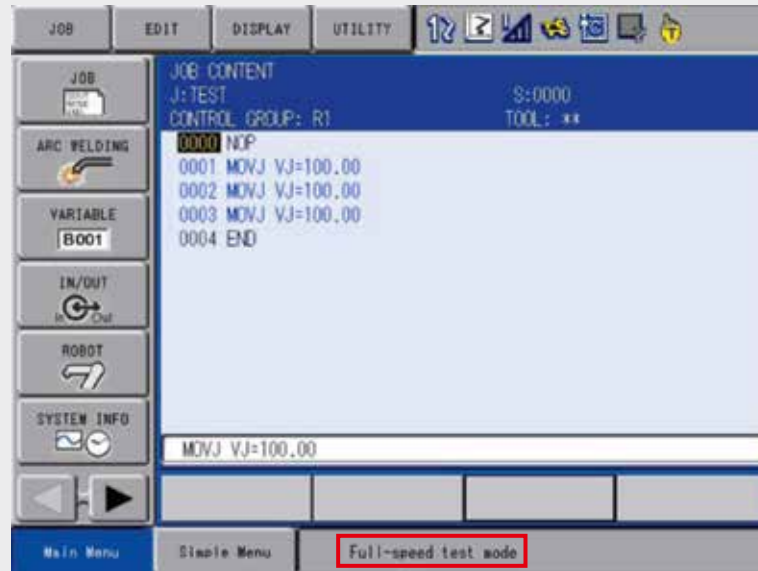
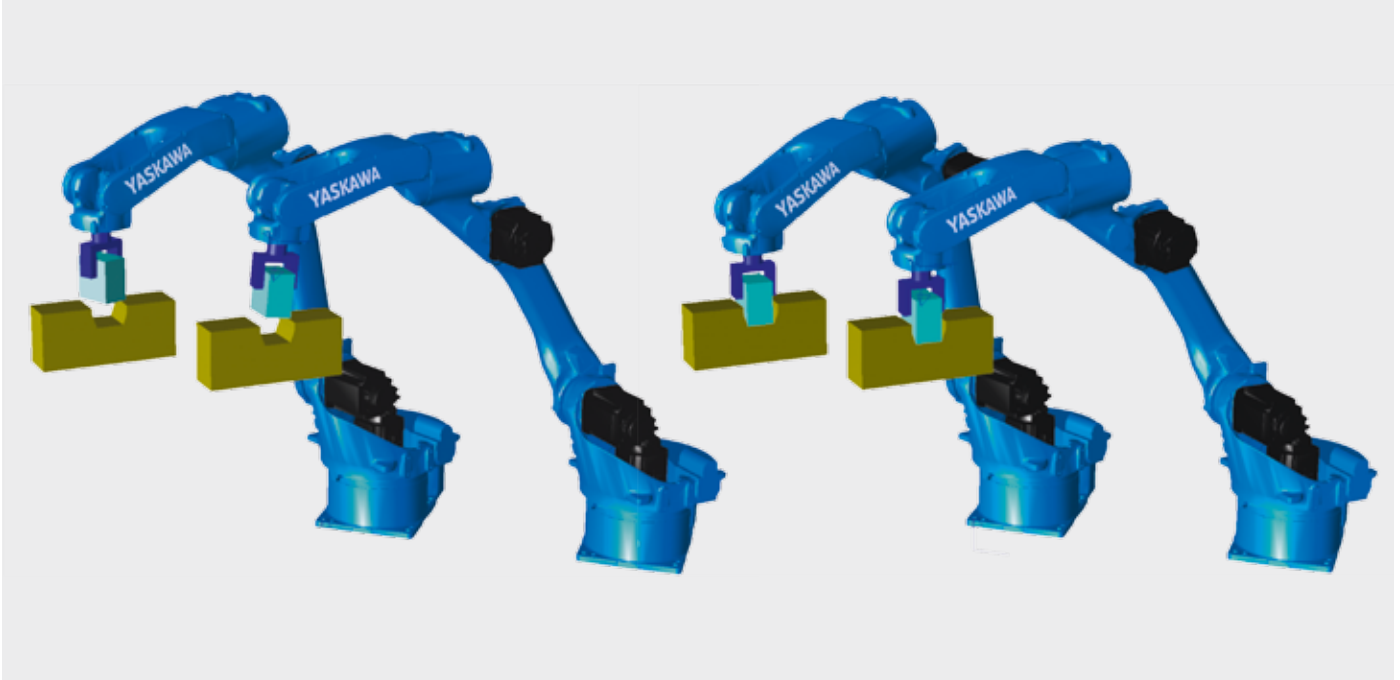This signal is used to reset the slow speed limit for the test run in the teach mode.

If this signal input circuit is short-circuited, the speed of the test run becomes 100% in the teach mode.

When the full-speed test mode is set, operation speed is set depending on the setting of manual speed as follows. Three levels can be defined (e.g. Low: 20 %, middle: 50 %, High: 75 %, fix value for Top: 100 %)

KEY BENEFITS

• Check whole process with up to 100 % speed in teach mode
• Test with process velocity

Link and
Linear Servo Float Multi Robot (182773)

The servo float function controls not only the position of the robot but both the position and force of the robot. Normally, even if an outer force is applied to the robot, the robot tries to maintain the current position and does not move because only the robot position is controlled. In that case, the servo float function provides flexible control on the position and posture of the robot, in response to the force applied from outside. It allows to overwrite (reteach) robot positions under consideration of current shift-values.

Link Servo Float Function
This function performs the servo float for each axis of the robot. This function is used when a force is applied only to a specific axis or when the servo float is applied to all axes of the robot because the direction in which the force is applied cannot be identified.

Linear Servo Float Function
This function performs the servo float for each coordinate axis of coordinate systems such as the robot coordinate, base coordinate, robot coordinate, user coordinate, and tool coordinate. This function is used when the force is applied only to the specific direction of each coordinate system.

Linear Servo Float Function Multi Robot
This function performs the servo float for each coordinate axis of coordinate systems such as the robot coordinate, base coordinate, robot coordinate, user coordinate, and tool coordinate. This function is used when the force is applied only to the specific direction of each coordinate system.

KEY BENEFITS

- No additional hardware is required
- **Link Servo Float Function**
  Can be activated by programmer for each axis
  or all together
- **Linear Servo Float Function**
  Can be activated by programmer for each coordinate
  system in each direction
- **Linear Servo Float Function Multi Robot**
  For every Robot Link Servo Float can be activated
  in a separate coordinate system.

# Automatic Backup **YRC1000 Ethernet Standard (181489)**

The system data can be collectively backed up so that the data can be immediately loaded and restored in case of an unexpected trouble such as data loss.

The automatic backup function offers a variety of modes to support different backup strategies.

KEY BENEFITS

• Backups the whole system data in a single file
• Backup modes: Scheduled backups, backup on mode switch, backup on controller start, backup by IO
• Various backup locations supported (Pendant CF card, internal CF card, internal RAM, internal USB)
• Retain an adjustable number of previous versions of the backed-up files
• Remote access to the backup by FTP or HighSpeedEthernetServer
• Get a notification when a new backup is available

Data Transmission **YRC1000 Ethernet Standard (181489)**

DCI

Job · Variable Transmission
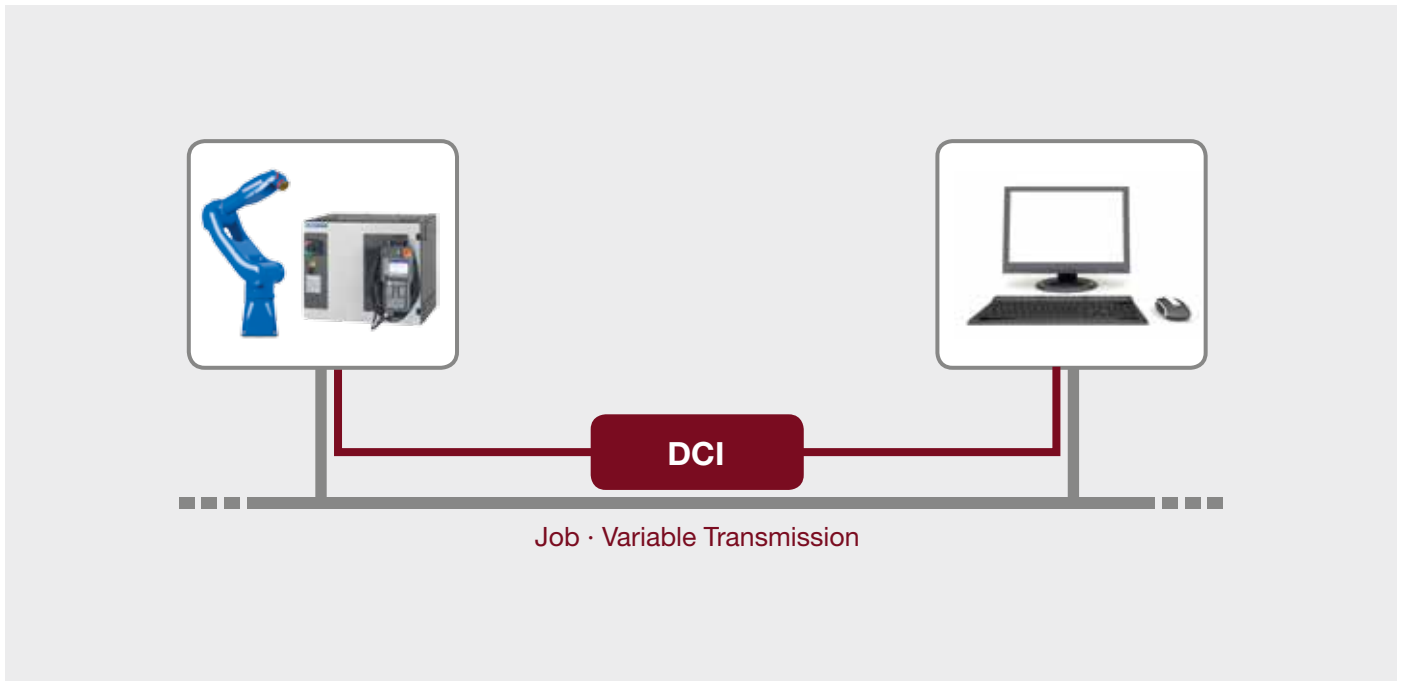
The "Data Transmission" function (DCI) allows to load and save jobs and variables from inform by using DCI commands.

FUNCTIONALITY OVERVIEW

- Job transmission (load, save and delete jobs)
- Variable transmission (load and save variables)

KEY BENEFITS

- Job and variable transmission to a host computer
- Based on BSC protocol
- Robot is communication master
- DCI instructions are embedded in inform jobs
- Uses the standard Ethernet Port.
  No additional hardware required.
- DCI server side can be implemented using
  MotoCom32 SDK or use existing software "MotoDCI32"

REQUIRED SOFTWARE

- MotoCom32 – The SDK provides the functionality for accessing YASKAWA robot controllers by a Windows-PC using BSC, EServer or High Speed EServer protocol or
- MotoDCI32 – Software to store robot jobs on a host computer

Ethernet FTP **YRC1000 Ethernet Standard (181489)**

Job · Condition/General Data · System Information
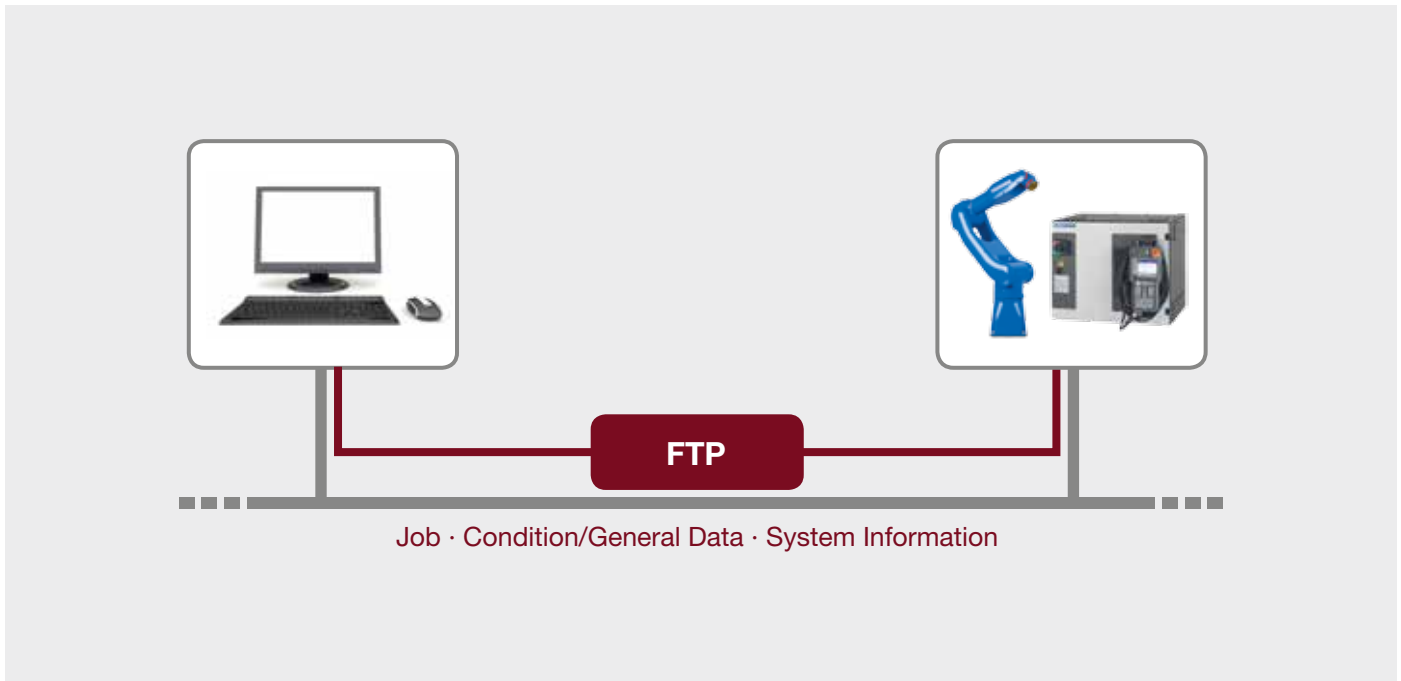
FTP is a common protocol for file transfer through Ethernet. The YRC1000 controller can be configured as FTP server and also as FTP Client. Depending on the mode it supports upload, download and deletion of files and grants access to jobs, system files and parameter files.
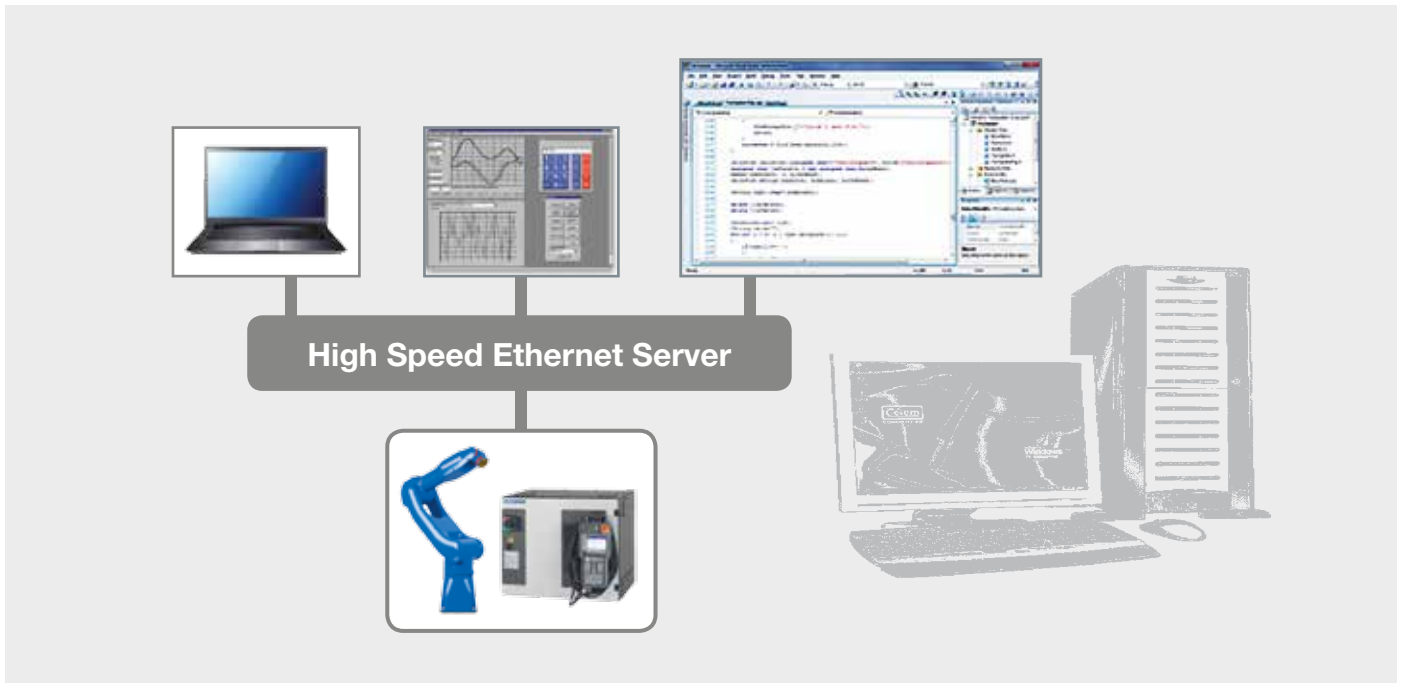
FUNCTIONALITY OVERVIEW

- FTP client mode. In client mode the YRC1000 is capable of uploading and downloading files to/from a ftp server using the teach pendant
- FTP Server mode. In server mode any FTP client is capable of uploading and downloading files to/from YRC1000 controller

KEY BENEFITS

- Common protocol for file transfer
- Supports encrypted communication
- Supports client and server mode (cannot be used at the same time)
- Access to jobs, system files and parameter files
- Uses the standard Ethernet Port. No additional hardware required
- CMOS saving via FTP

High Speed Ethernet Server

YRC1000 Ethernet Standard (181489)

High Speed Ethernet Server

The "High Speed Ethernet Server" protocol is the current "General purpose" protocol for communication between the YRC1000 controller and external devices. It provides a higher performance and functionality over the older protocols like EServer thus it's the recommended protocol for developing new applications.

FUNCTIONALITY OVERVIEW

- Read robot status (Current position, Alarm, Error, Servo Status, …)
- Control the system (Servo on, Start, Hold, Job call, ...)
- Read or write variables, registers and IO signals
- File control (Load, Save, and Delete jobs/files), access backup data

KEY BENEFITS

- Recommended protocol for developing new applications
- Based on UDP
- Use in custom projects by implementing the protocol or by using the MotoCom32 SDK
- Faster communication compared to older protocols (Ethernet Server, BSC)
- Uses the standard Ethernet Port. No additional hardware required
- Protocol is also available on DX100, DX200 and FS100

OPTIONAL SOFTWARE

- MotoCom32 – The SDK provides the functionality for accessing YASKAWA robot controllers by a Windows-PC using BSC, Ethernet Server or High Speed Ethernet Server protocol

Ethernet WWW **YRC1000 Ethernet Standard (181489)**
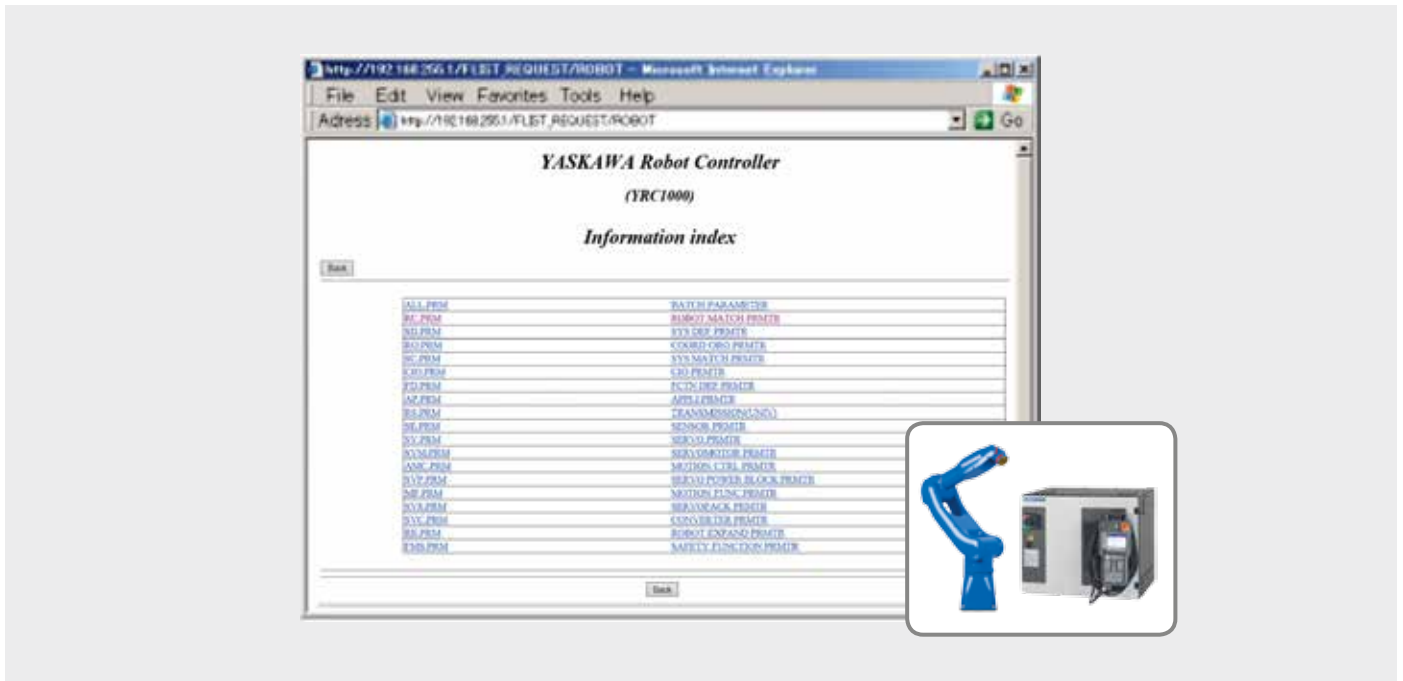
The "Ethernet WWW" function allows to access the internal data of the YRC1000 controller by any web browser.
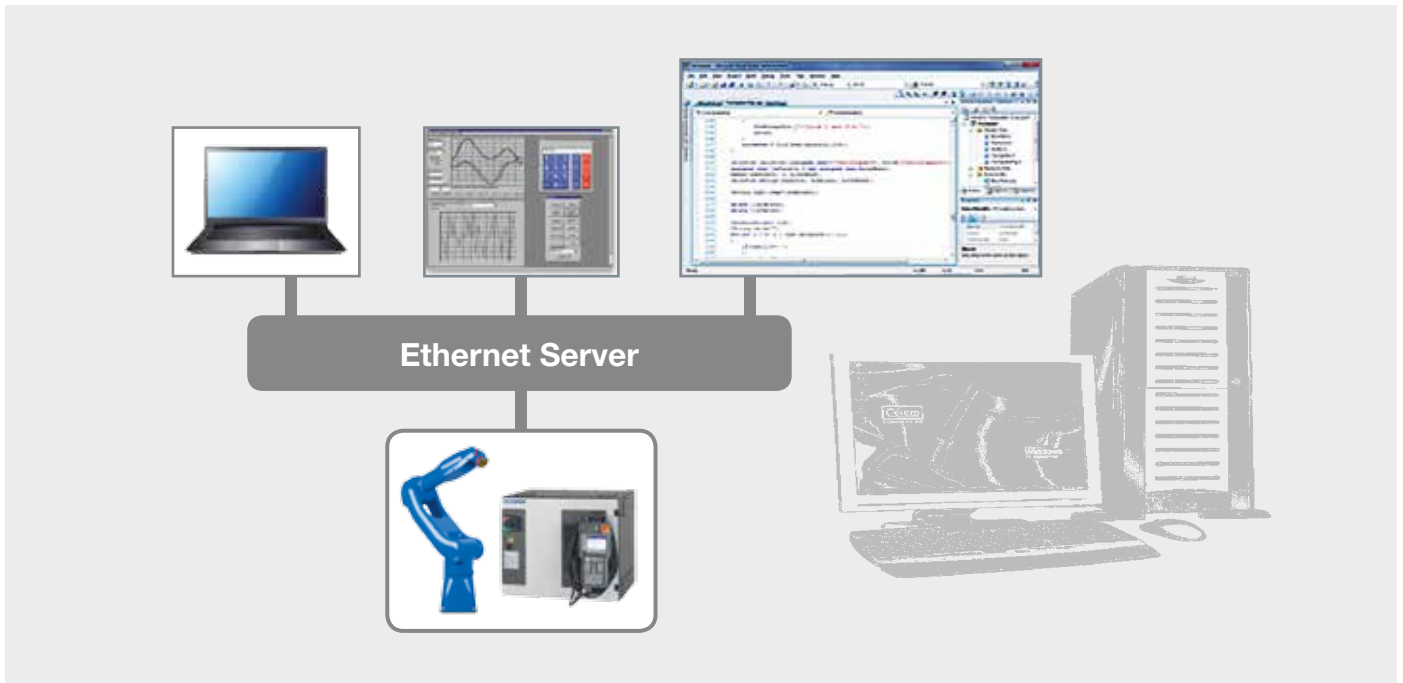
FUNCTIONALITY OVERVIEW

- Browsing the internal data of YRC1000
- View jobs, parameters and system files by any web browser

KEY BENEFITS

- Easy access to YRC1000 internal data
- Uses the standard Ethernet Port.
  No additional hardware required

Ethernet Server YRC1000 Ethernet Standard (181489)

Ethernet Server

The "Ethernet Server" protocol is an improvement of the BSC
protocol concerning performance and multi-client support.
The functionality is identical to the BSC protocol.

MAIN FUNCTIONS

- Read robot status (Current position, Alarm, Error,
  Servo Status, …)
- Control the system (Servo on, Start, Hold, Job call, ...)
- Read or write variables, registers and IO signals
- File control (Load, Save, and Delete jobs/files)

KEY BENEFITS

- Protocol is based on TCP/IP
- Use in custom projects by implementing the protocol
  or by using the MotoCom32 SDK
- Uses the standard Ethernet Port. No additional hardware
  required
- Protocol is also available on DX100, DX200 and FS100
- Multi-client support

OPTIONAL FUNCTIONS

- 181489_Function YRC1000 High Speed Ethernet Server –
  The "High Speed Ethernet Server" function is recom-
  mended for developing new communication applications

OPTIONAL SOFTWARE

- MotoCom32 – The SDK provides the functionality for
  accessing YASKAWA robot controllers by a Windows-PC
  using BSC, EServer or High Speed EServer protocol

Ethernet Standard
Data Transmission **YRC1000 Ethernet Standard (181489)**
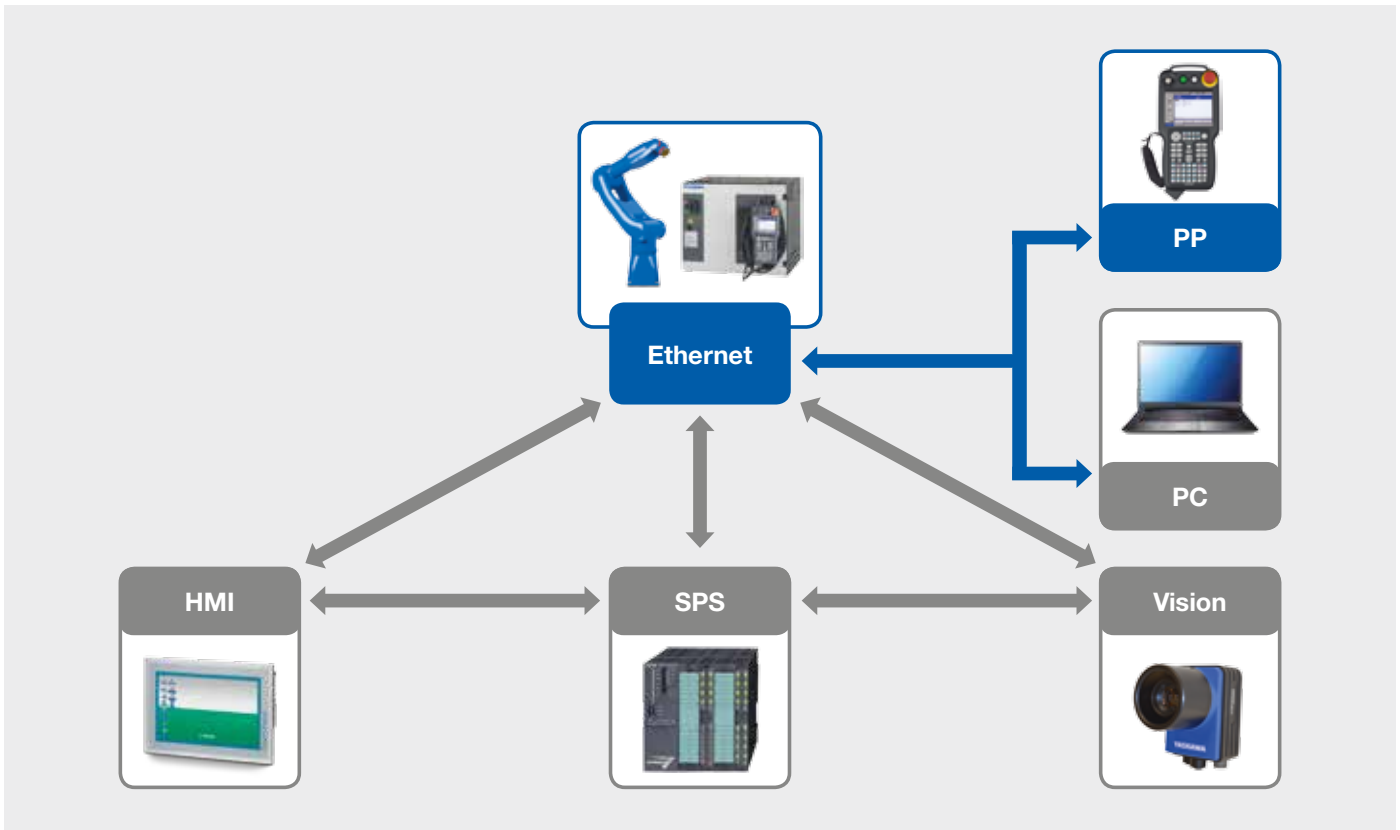
The "DCI" function allows to load and save jobs and variables from inform by using DCI commands.

MAIN FUNCTIONS

- Job transmission (Load, save and delete jobs)
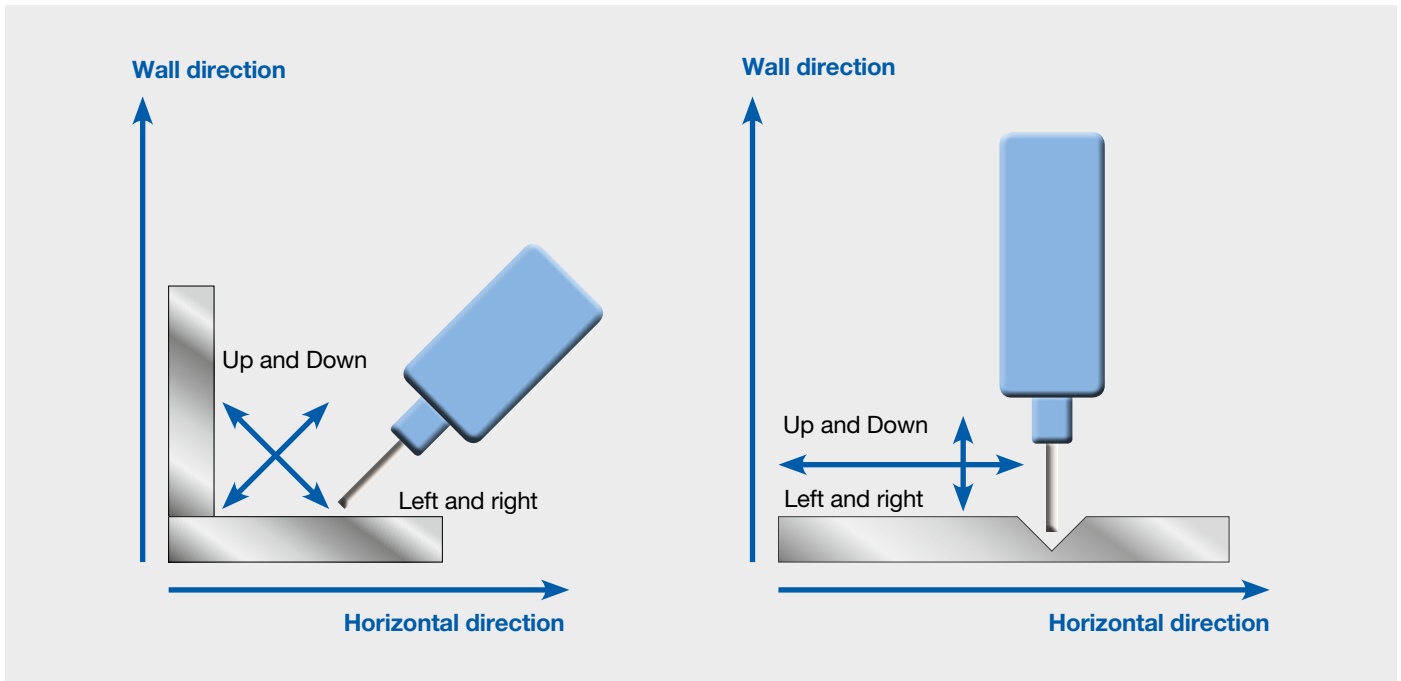- Variable transmission (Load and save variables)

KEY BENEFITS

- Job and variable transmission to a host computer
- Based on BSC protocol
- Robot is communication master
- DCI instructions are embedded in inform jobs
- Uses the standard Ethernet Port. No additional hardware required.
- DCI server side can be implemented using MotoCom32 SDK or use existing software "MotoDCI32"

REQUIRED SOFTWARE

- MotoCom32 – The SDK provides the functionality for accessing Yaskawa robot controllers by a Windows-PC using BSC, EServer or High Speed EServer protocol
- MotoDCI32 – Software to store robot jobs on a host computer

ARC Sensor Comarc Basic (197883)

Wall direction

Up and Down

Left and right

Horizontal direction

Wall direction

Up and Down

Left and right

Horizontal direction

ARC Sensor Comarc Basic is the function with which the robot performs welding while automatically modifying deviation from welding lines based on the variation information of welding current in welding.

The welding machine with constant voltage characteristic has the property that welding current changes as the distance between the chip and base metal changes. The arc sensor utilizes this property. This information is acquired in the robot side while performing weaving for the welding torch, modification is performed in the horizontal directions of welding lines for the direction of robot movement so that

a current difference between the both sides of weaving is decreased, and simultaneous modification is performed in the vertical directions of welding lines for the vertical directions so that the preset current value is reached.

KEY BENEFITS

• Modification position in horizontal and vertical direction
• Pass-over Function
• Comarc works only with simple weaving
• No CMT or Aluminum welding!

Hover Weaving (197884)
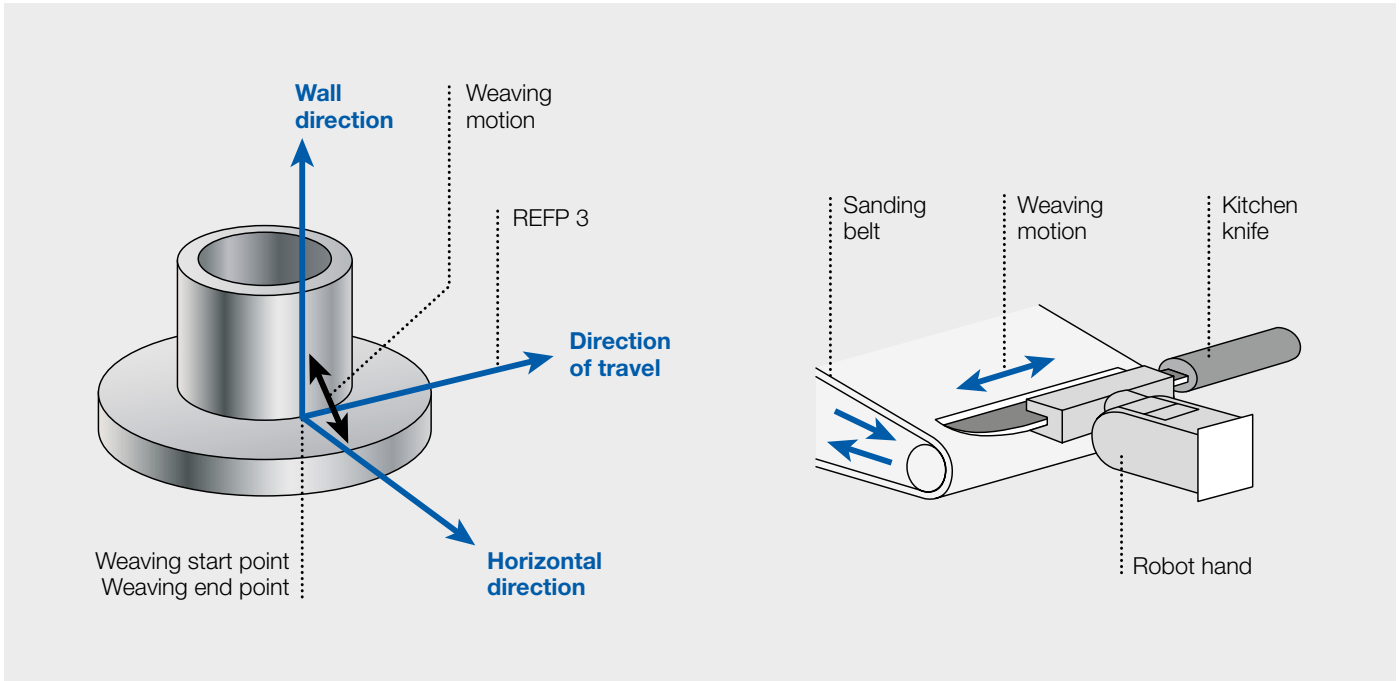
The "hover weaving function" is special weaving mode for applications in which robot positions for start-/end-points are the same: During process robot does not move on a trace!.
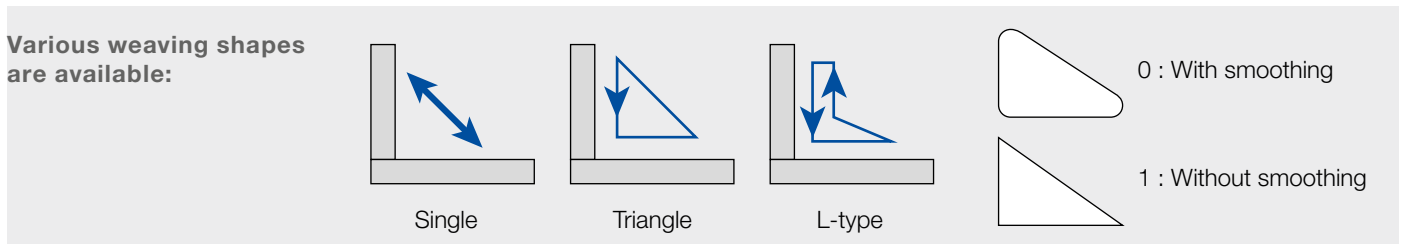
So there's no travel direction for the robot and therefore weaving direction cannot be determined. For these sequences "hover weaving" enables usage of weaving function.

Left figure: Example for application welding
Workpiece is operated by turn axis, start-/end-position of robot is the same, no synchronized motion.

**Right figure: Example for application grinding/polishing**
The work piece which is held by the robot arm provides just one position in relation to the grinding belt. Therefore there is no moving direction. Weaving is the only movement.

Various weaving shapes are available:

Single   Triangle   L-type

0 : With smoothing

1 : Without smoothing

KEY BENEFITS

- Expansion of weaving function enables weaving for processes where the robot itself is not doing any movement
- Available for application arc welding and general
- Works also in combination with arc sensor "Comarc"

Memo Play (197880)
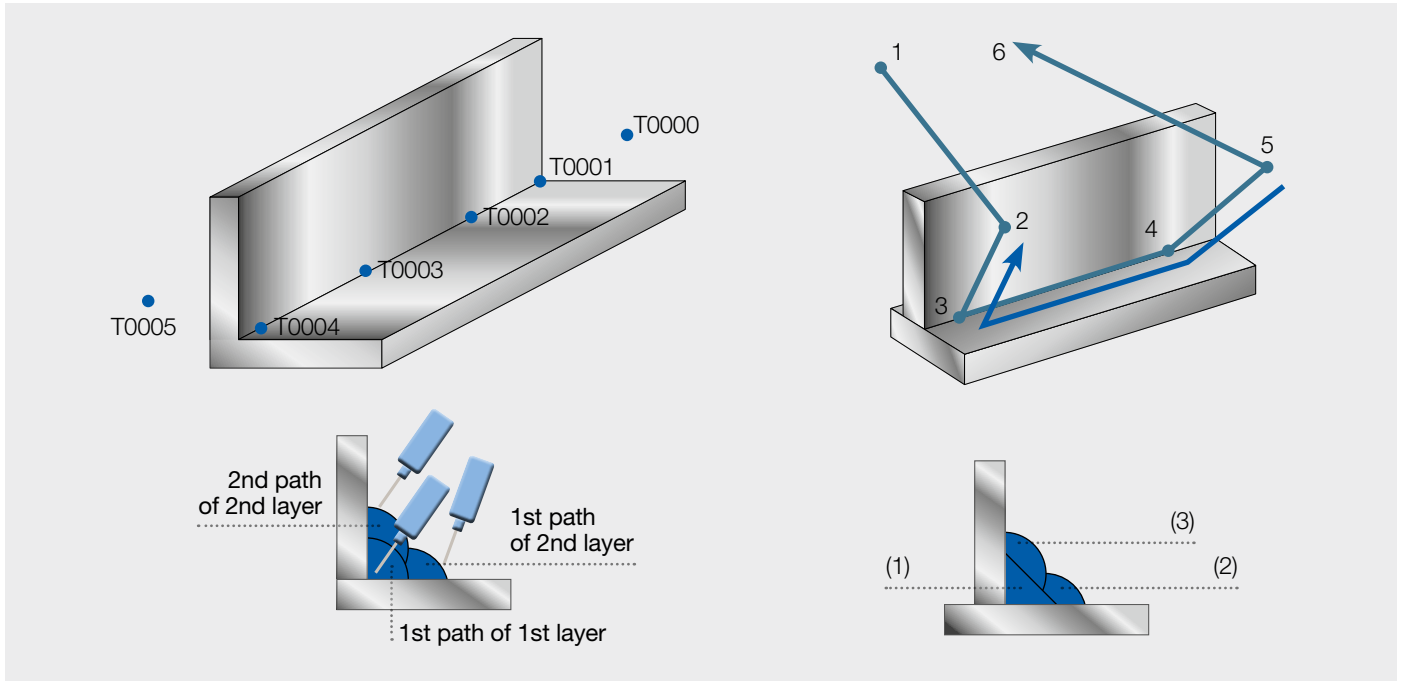
This function is fixed part of Multi-Layer welding package.

It allows to record any robot path.

The path will be stored in files and can be reproduced as often as you want.

Example:
- Work piece tolerances or displacements are requesting the use of arc sensor Comarc.
- In the first layer arc sensing will compensate the offsets between taught and current positions. This "new" path will be stored and can be reproduced in all following layers.

KEY BENEFITS

- Useful function in multi layer welding package
- Instead of Comarc you can also use Laser Tracking sensor with MotoEyeLT for first layer!
- Memory extension mandatory

Euler Angle (197881)
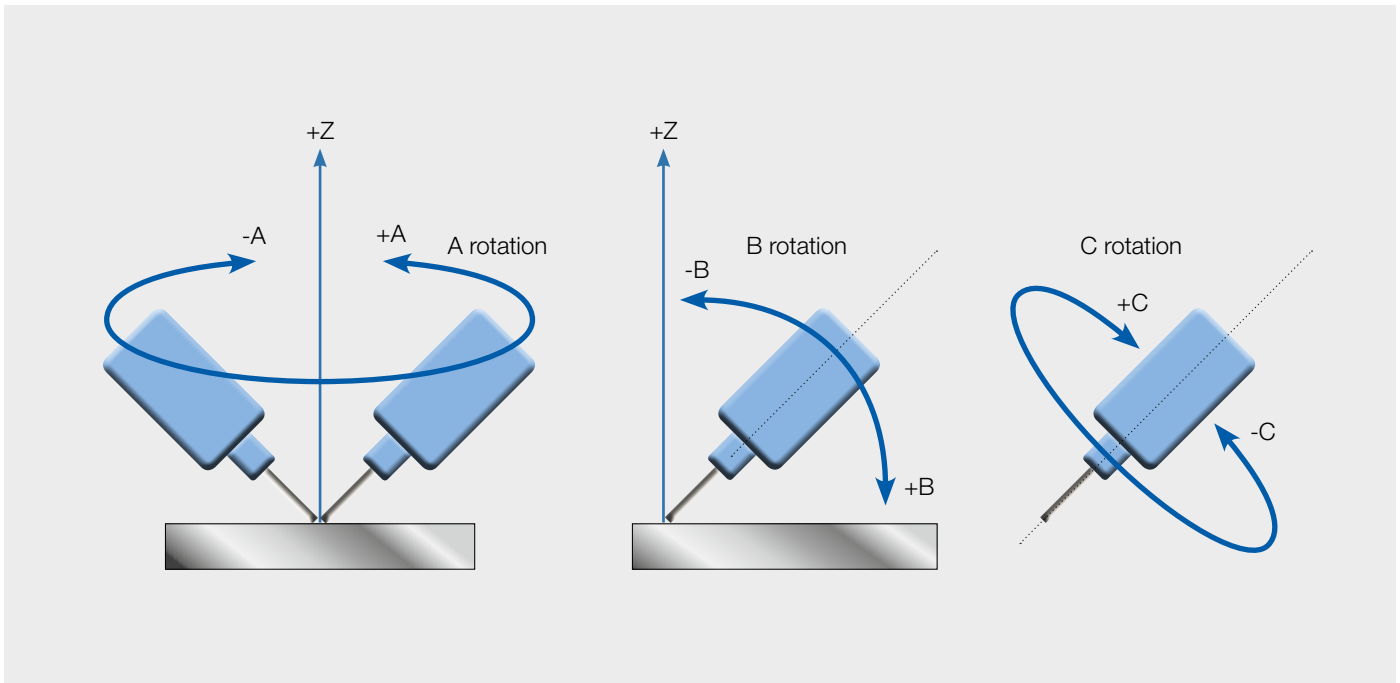
Euler angle function is fixed part of multi layer welding package. It is special tool coordinate system which follows popular nomenclature of torch angles used within manual welding:

A-angle: same as forehand/backhand welding.

B-angle: torch orientation in relation to opening angle of welding groove (tendency towards the wall or towards ground plate).

C-angle: no meaning for manual welding but robot can additionally use rotation around gas nozzle to get into more suitable position.

Please beware two important points for basic understanding of torch angles according to "Euler": This coordinate system was basically created for fillet seams in horizontal position.

Caution: Only under these conditions the function can work properly!!! All other positions will miss a correct calculation for Z-direction which is related to world's Z-coodinate (please refer pictures).

Jog operations sometimes become complicated because Euler doesn't work like rectangular coordinate system. The picture below shows that xyz-direction is only 2-dimensional plane! Programmer has to get used to this situation.

The behaviour is the same all over the robot's "world" and is used to perform same multi layer designs at different work-piece positions in the cell (including rotation around z-axis).

This means that a multi-layer design which was set once, can be repeated at any position in your cell as often as wished (restrictions above must be considered).

KEY BENEFITS

- Part of multi-layer package
- Tool coordinates like commonly used for manual welding
- Beware restrictions caused by non-rectangular and 2D character
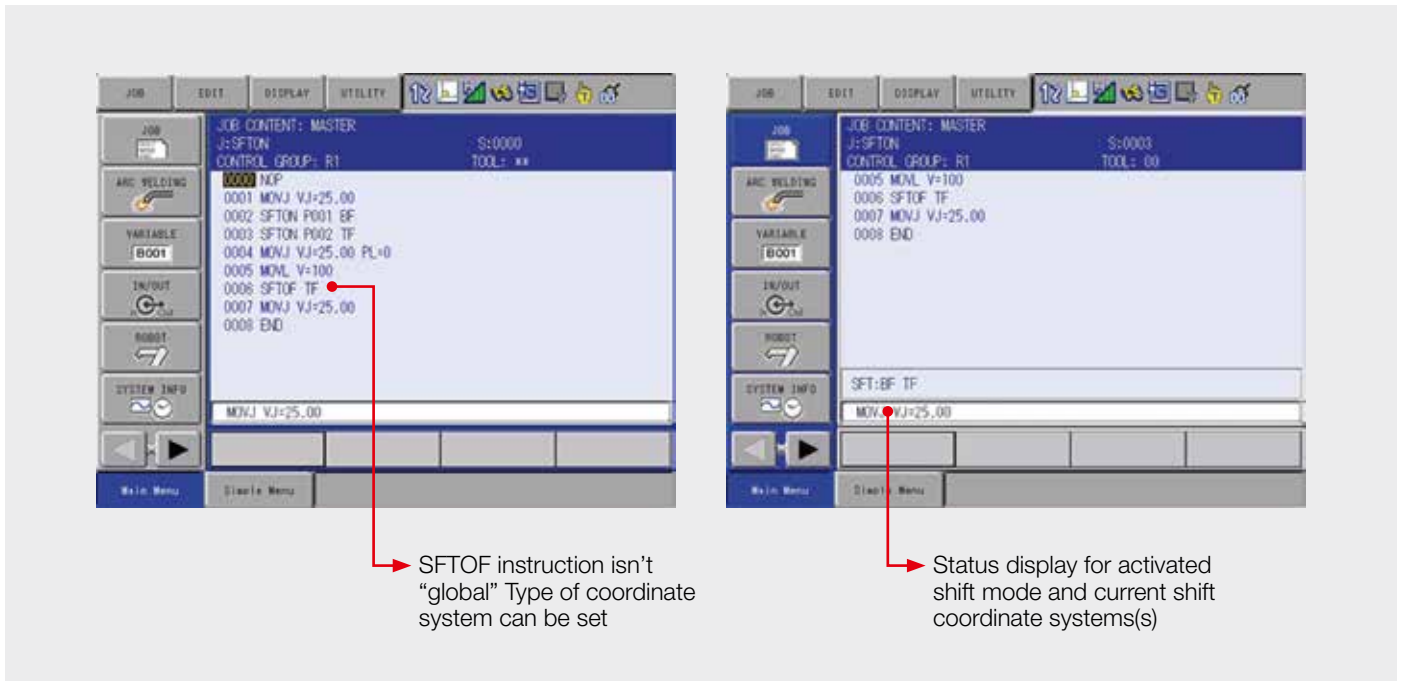- Same multi-layer design repeatable at any workpiece position

Special Shift (197882)

SFTOF instruction isn't "global" Type of coordinate system can be set

Status display for activated shift mode and current shift coordinate systems(s)

This function will only effect, if SHIFT-instruction is used!

It easies and expands the SHIFT instruction performance. If shift instruction is used with different coordinate systems at the same time this function should be compulsory (for example MultiLayer-function)!

The additional features are shown in pictures above.

KEY BENEFITS

• Useful expansion for any SHIFT-programming structure
• Easier and more comfortable use of SHIFT-function
• Use it wherever overlay of shift values in different coordinate systems becomes necessary

Graphical Arc Monitoring (197888)
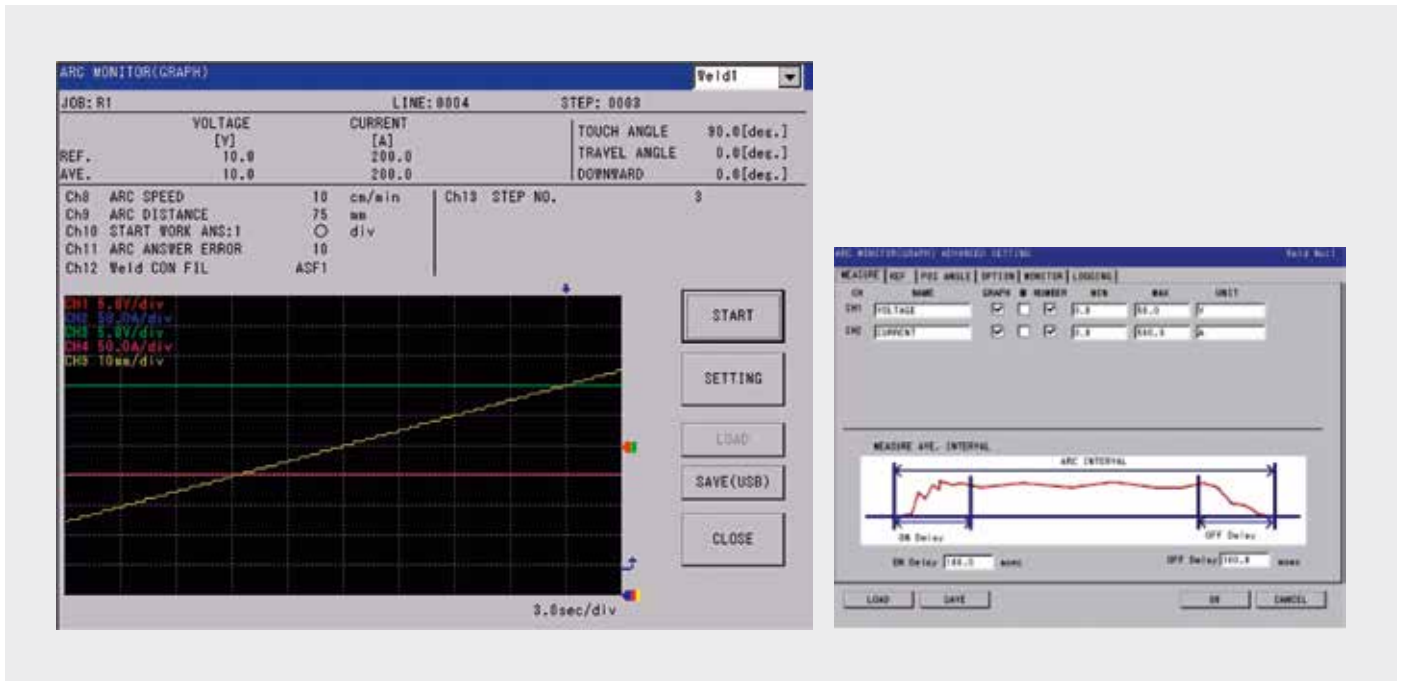
The graphical arc monitoring function consists of the following functions:
- Monitoring function
- Logging function

The Graphical Arc monitoring function samples the arc-welding related data and shows it on the programming pendant as a graph and numeric values. This function can also set the sampling data as a trigger and start displaying the data, and save the memory data of the definite period of time continuously in the external memory unit in the order of time scales.

And also this function can save the sampling data of the welding condition and others in the external memory unit automatically apart from the arc monitor graph window.

Only for Analog Power sources and YASKAWA Weldcom interfaces.

KEY BENEFITS

- Better visualization – Show information by numeric values and graph
- Storable by external memory

Welding Condition Guide (197887)
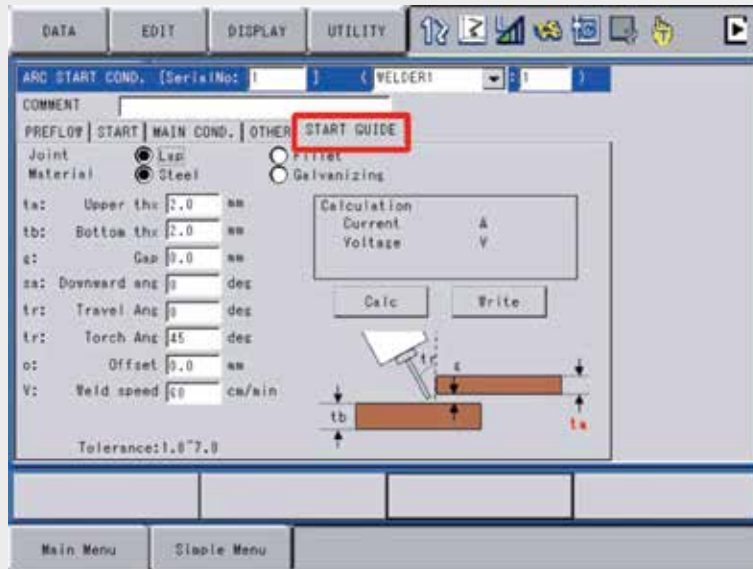
"Welding condition guide" is a function that calculates the currentvalue and the voltage by using the welding conditions, such as the welding position and the joint, and sets the values into the displaying arc start condition file.

The calculated current value and voltage by the welding condition guide are estimated value.
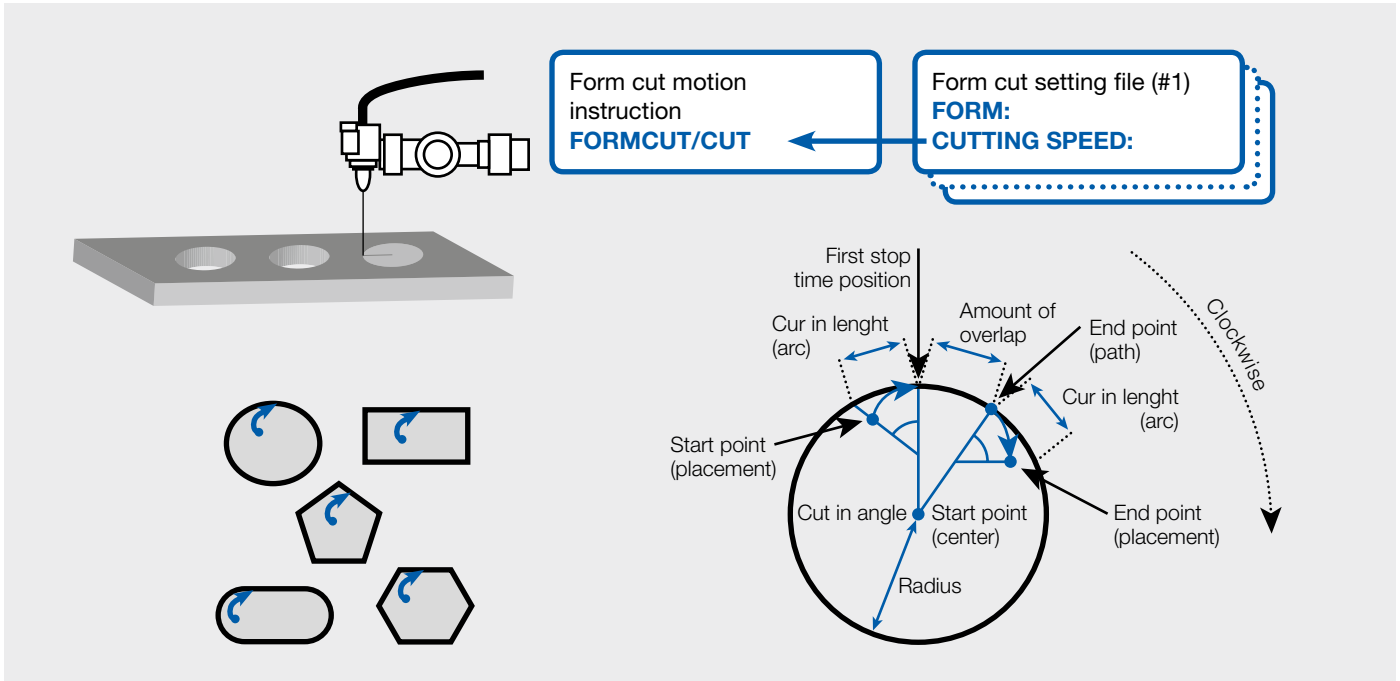
The welding condition guide may not to reach the optimal condition because of the differences, such as a real material, wire stickout, gas or welding waveform. Therefore, adjust the conditions while confirming the weld bead by performing the actual welding.

Support for analogue controlled welding power sources.

KEY BENEFITS

• Easily find and adjust welding parameters
• Helpful to adjust the welding positions

Form Cutting (197915)

Form cut motion instruction
FORMCUT/CUT

Form cut setting file (#1)
FORM:
CUTTING SPEED:

First stop time position

Cur in lenght (arc)

Amount of overlap

End point (path)

Cur in lenght (arc)

Start point (placement)

Cut in angle

Start point (center)

End point (placement)

Radius

Clockwise

The form cutting function operates the robot in the specified form by executing one dedicated instruction ("FORMCUT"/ "CUT" instruction) according to the condition set in the form cut setting file. This function can be used in the work for cutting the work piece to a form using the laser cutter or others gripped by the manipulator.

KEY BENEFITS

• Teaching time can be reduced
• Path accuracy is improved

TCP Control – Basic for ARC
(Q-Set Basic) (197885)

*Necessary hardware
for using function*

Visual torch inspection and TCP adjustment function

The YASKAWA "TCP Control – Basic for ARC" (Q-Set Basic) is a visual torch inspection and TCP adjustment function for MOTOMAN welding robots. An inspection program is executed at regular intervals to check the wire position on the torch. In this way the contact tip can be checked for accurate positioning and wear and the wire quality (twist).

The robot enters the testing device with a torch in such a way that it interrupts two laser light beams with the wire, while keeping the torch intact.

If the tool is deformed, then at least one of the laser light barrier isn't interrupted. In that case either an alarm can be displayed and the cause of the error can be fixed by the operator, or the automatic measurement of the torch can be started.

In case of the automatic measurement and correction of the programs, the torch (wire) is measured with the light beams in X, Y and also in Z direction by means of a special robot program.

The new tool data is now used to convert and to correct all programs as Relative Jobs. If the maximum permissible torch deviations are exceeded, an error message is displayed.

KEY BENEFITS

- Quality assurance
- Higher availability through early detection of wear on the torch
- Torch check in regular intervals
- Automatic program correction after collision
- Automatic TCP adjustment after torch change
- Automatic tool-angel correction (optional)
- Automatic correction of the Tool-data
- Error message if the maximum deviation of the TCP is exceeded

Notes

Notes

YASKAWA GROUP

AT   YASKAWA Austria
Schwechat/Wien
+43(0)1-707-9324-15

CZ   YASKAWA Czech s.r.o.
Rudná u Prahy +420-257-941-718

ES   YASKAWA Ibérica, S.L.
Gavà/Barcelona +34-93-6303478

FR   YASKAWA France SARL
Le Bignon +33-2-40131919

FI   YASKAWA Finland Oy
Turku +358-(0)-403000600

GB   YASKAWA UK Ltd.
Banbury +44-1295-272755

IT   YASKAWA Italia s.r.l.
Torino +39-011-9005833

IL   YASKAWA Europe Technology Ltd.
Rosh Ha'ayin +972-3-9004114

NL   YASKAWA Benelux B.V.
Eindhoven +31-40-2895500

PL   YASKAWA Polska Sp. z o.o.
Wrocław +48-71-7928670

RU   YASKAWA Nordic AB
Moskva +46-480-417-800

SE   YASKAWA Nordic AB
Torsås +46-480-417-800

SI   YASKAWA Slovenia
Ribnica +386-1-8372-410

TR   YASKAWA Turkey Elektrik
Ticaret Ltd. Sti.
İstanbul +90-216-5273450

ZA   YASKAWA Southern Africa (PTY) Ltd
Johannesburg +27-11-6083182

DISTRIBUTORS

BG   ARAMET ROBOTICS Ltd.
Yambol +359-885 317 294

Kammarton Bulgaria Ltd.
Sofia +359-02-926-6060

DK   Robotcenter Danmark
Løsning +45 7022 2477

EE   RKR Seadmed OÜ
Tallinn/Estonia +372-68-35-235

GR   Gizelis Robotics
Schimatari Viotias +30-2262057199

HU   Flexman Robotics Kft
Budapest +36 1 259 0981

LT   Profibus UAB
Panevezys +370-45-518575

NO   Skala Robotech AS
Lierstranda +47-32240600

PT   ROBOPLAN Lda
Aveiro +351-234 943 900

RO   Sam Robotics srl
Timisoara +40-720-279-866

MPL Automation S.R.L.
Satu Mare +40 (0) 261 750 741

YASKAWA Headquarters

YASKAWA Europe GmbH
Robotics Division
Yaskawastraße 1
85391 Allershausen, Germany
Tel. +49 (0) 8166/90-0
Fax +49 (0) 8166/90-103

robotics@yaskawa.eu.com
www.yaskawa.eu.com

YASKAWA ACADEMY
and sales office Frankfurt

YASKAWA Europe GmbH
Robotics Division
Hauptstraße 185
65760 Eschborn, Germany
Tel. +49 (0) 6196/77725-0
Fax +49 (0) 6196/77725-39

TÜV CERT
EN ISO 9001
Zertifikat Nr. 20 100 9864
www.tuv.at

YASKAWA