14 Working with a higher-level controller

14.1 Overview

The following contents are explained in this training module:

- Preparing program start from a PLC
- Adapting the PLC interface

14.2 Preparation for program start from PLC

Robot in system group

If robot processes are to be controlled centrally (by a host computer or PLC), this is carried out using the *Automatic External* interface.

Fig. 14-1: PLC connection

System structure principle

The *Automatic External* interface allows robot processes to be controlled by a higher-level controller (e.g. a PLC).

The following are required for communication between the PLC and the robot:

- There must be a configured field bus physically present between the robot and the PLC, e.g. PROFINET.
- Signals for the robot processes must be transmitted via the field bus. This is achieved by means of configurable digital inputs and outputs in the *Automatic External* interface.
  - **Control signals to the robot (inputs):**
    The higher-level controller transmits the signals for the robot processes (e.g. motion enable, fault acknowledgement, program start, etc.) to the robot controller via the Automatic External interface.
  - **Robot state (outputs):**
    The robot controller transmits information about operating states and fault states to the higher-level controller.
- An adapted **CELL.SRC**
  Organization program for selecting robot programs from outside.
- Selection of **Automatic External mode**
  Operating mode in which a host computer or PLC assumes control of the robot system.

Safety instructions – external program start

Once the CELL program has been selected, a BCO run must be carried out in T1 or T2 mode.

⚠ WARNING A BCO run is executed as a PTP motion from the actual position to the target position if the selected motion block contains the motion command PTP. If the selected motion block contains LIN or CIRC, the BCO run is executed as a LIN motion. Observe the motion to avoid collisions. The velocity is automatically reduced during the BCO run.

If the BCO run is successful, no further BCO run is performed in the case of the external start.

⚠ WARNING There is no BCO run in Automatic External mode. This means that the robot moves to the first programmed position after the start at the programmed (not reduced) velocity and does not stop there.

Procedure – external program start

Preconditions

- T1 or T2 mode
- Inputs/outputs for Automatic External and the program CELL.SRC are configured.

1. Select the program CELL.SRC in the Navigator. The CELL program is always located in the directory KRC:\R1.
2. Set program override to 100%. (This is the recommended setting. A different value can be set if required.)

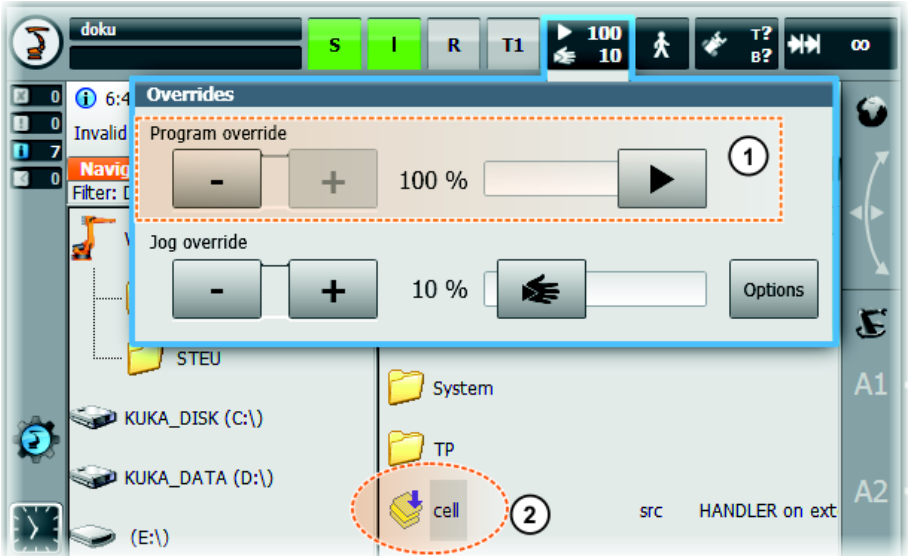

Fig. 14-2: Cell selection and program override setting

1 POV setting
2 Cell.src selection

3. Carry out a BCO run:
   Press and hold down the enabling switch. Then press the Start key and hold it down until the message “Programmed path reached (BCO)” is displayed in the message window.
4. Select “Automatic External” mode.
5. Start the program from a higher-level controller (PLC).

14.3 Adapting the PLC interface (Cell.src)

Cell.src organization program

The organization program Cell.src is used to manage the program numbers transferred by the PLC. It is located in the folder “R1”. Like any other program, the Cell program can be customized, but the basic structure of the program must be retained.

Structure and functionality of the Cell program

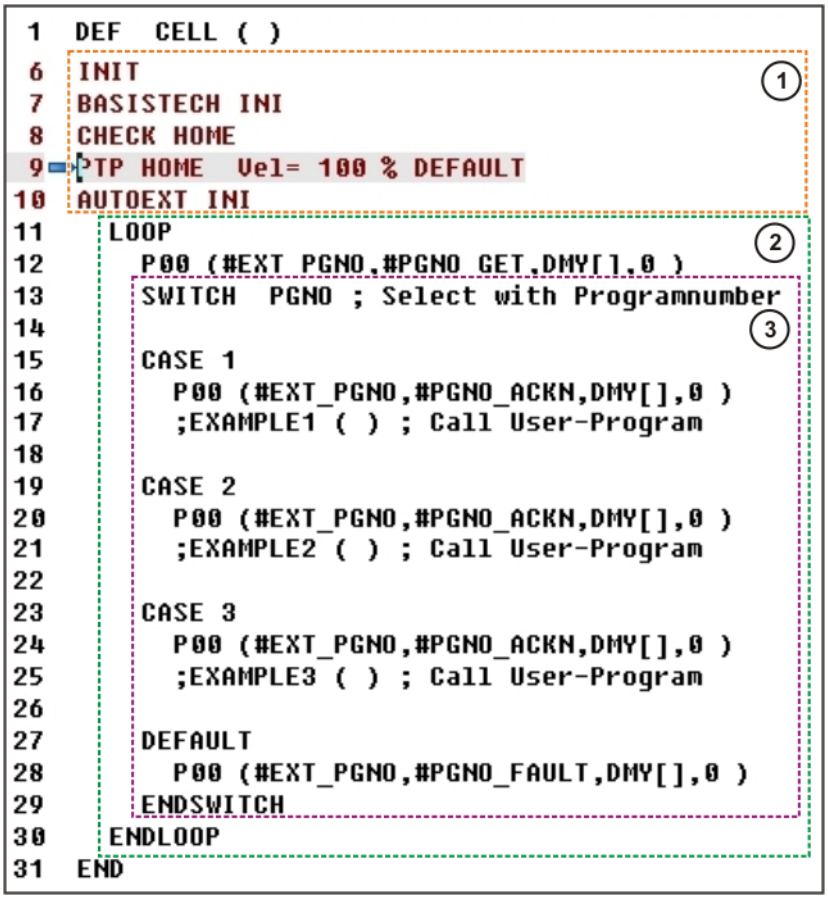

Fig. 14-3: Cell program

1	Initialization and home position ■ Initialization of the basic parameters ■ Check of the robot position after the home position ■ Initialization of the Automatic External interface
2	Endless loop: ■ Polling of the program number by the "P00" module ■ Entry into the selection loop with the program number determined.
3	Program number selection loop ■ Depending on the program number (stored in the variable “PG-NO”), the program jumps to the corresponding branch (“CASE”). ■ The robot program entered in the branch is then executed. ■ Invalid program numbers cause the program to jump to the default branch. ■ Once executed, the loop is repeated.

Procedure

1. Switch to the user group “Expert”.
2. Open CELL.SRC.

3. In the “CASE” sections, replace the name “EXAMPLE” with the name of the program that is to be called via the respective program number. Delete the semicolon in front of the name.

```
LOOP
  P00 (#EXT_PGNO,#PGNO_GET,DMY[],0 )
  SWITCH  PGNO ; Select with Programnumber

  CASE 1
    P00 (#EXT_PGNO,#PGNO_ACKN,DMY[],0 )
    main()

  CASE 2
    P00 (#EXT_PGNO,#PGNO_ACKN,DMY[],0 )
    body_38()
    body_515()

  DEFAULT
    P00 (#EXT_PGNO,#PGNO_FAULT,DMY[],0 )
  ENDSWITCH
ENDLOOP
```

Fig. 14-4: Example of an adapted Cell program

4. Close the program and save the changes.