

### CMMT-AS as auxiliar Axis working with Sinumerik

The following documentation describes how a CMMT receives a value over an "R-Variable" from the Sinumerik control. That value is used as set position.

When the G-Code is started, the program is paused in an "M" instruction and restarted once the CMMT has reached the desired position.

CMMT-AS

Siemens Sinumerik

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### Caution

A previous investigation controlling a CMMT on a Sinumerik 840D as a NC axis came to the following conclusion:

*“It is **not possible** to connect the CMMT as a **NC Axis**, because CMMT does not support Telegram 136 which is mandatory for an NC Axis. This possibility is not given. Also, the Siemens drives all use Drive-CliQ for communication.”*

Siemens provides an [Application Note](#) how to use a Sinamics S210 as a NC axis on a Sinumerik MC.

The goal is to check whether this Application Note can be used also with our CMMT to run a CMMT.

The answer in this case is clear: it is not possible to use the CMMT as an NC axis following the application note.

With the CMMT in TiA we do not have a possibility to configure telegrams like with the S210.

See following configuration options:

### Configuration options S210:

The screenshot shows the 'PROFINET interface [PROFINET]' window with the 'General' tab selected. Under 'Telegram configuration', 'Drive control-Telegrams' is expanded, and 'Send (Actual value)' is selected. The configuration fields are as follows:

Drive	Partner
Name: Drive control-Telegrams	PLC_1
Role: Device	Controller
IP address: 192 . 168 . 0 . 2	192 . 168 . 0 . 1
Telegram: SIEMENS telegram 105	
Slot: 3	
Start address: PZD 1	I 1800
Length: 10 words	10 words
Extension: --	--
Organization block: --	--
Process image: --	PIP NCK
Hardware identifier: --	304

The screenshot shows the 'PROFINET interface [PROFINET]' window with the 'General' tab selected. Under 'Telegram configuration', 'Drive control-Telegrams' is expanded, and 'Receive (Setpoint)' is selected. The configuration fields are as follows:

Drive	Partner
Name: Drive control-Telegrams	PLC_1
Role: Device	Controller
IP address: 192 . 168 . 0 . 2	192 . 168 . 0 . 1
Telegram: SIEMENS telegram 105	
Slot: 3	
Start address: PZD 1	Q 1800
Length: 10 words	10 words
Extension: --	--
Organization block: --	--
Process image: --	PIP NCK
Hardware identifier: --	304

It is furthermore not confirmed, if this application note will also work with a Sinumerik ONE because the example is based on a Sinumerik MC.

Based on the feedback from Siemens so far, it is not possible today and not planned to use a S210 on a Sinumerik ONE as a NC axis.

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## 1. Components – Hardware and Software

For the test with only Siemens components the following parts are used:

HW:

Component	Type
Servo drive	CMMT-AS
Servo Motor	EMMT-AS
Sinamics S120 Control Unit	6SL3040-1MA01-0Axx
Sinamics S120 Smart Line Module	6SL3430-6TE21-6Axx
Sinamics S120 Double Motor Module	6SL3420-2TE15-0Axx
Simotics Motor	1FK7022-5AK71-1LH0
Motor- + Encodercables	-
Sinumerik ONE PPU 1740	6FC5317-4AA00-1CA0
Sinumerik MCP 398C	6FC5303-0AF25-0AA0
Sinumerik ONE CNC SW SD-card	6FC5852-1XG15-0YA8

SW:

Component	Type
Festo Automation Suite	
Sinumerik Step 7 TiA V17 Upd.6	-
Sinumerik Step 7 Toolbox V17 Upd.12	-
License CNC-SW 31-3 (from SW 6.0)	6FC5852-1XF00-0YB0
License Sinumerik Operate /NCU	6FC5800-0BS00-0YB0

## 2. Commissioning CMMT-AS

Please refer to application notes from CMMT-AS: “CMMT-AS-PN controlled by SINAPOS functions block with Siemens S7 1500 controller”.

[SINAPOS | Festo DE](#)

### 3. Commissioning Sinumerik ONE

#### 3.1 Commissioning Sinumerik ONE with Sinamics S120, Simotics S-1FK7

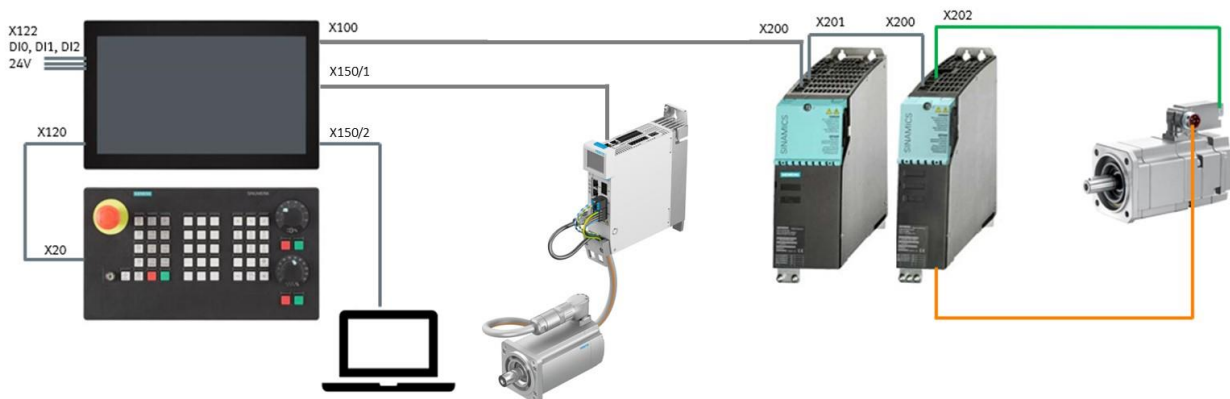
In general Siemens provides a lot of useful documentations and manuals for their Sinumerik ONE system.

A very good overview with links to different information provides the following page:

[Technical documentation for SINUMERIK ONE, version 6.14 - ID: 109782281 - Industry Support Siemens](#)

#### 3.2 Electrical Commissioning

Components are connected like the following:



Please make sure DI0, DI1 and DI2 at X122 on the Sinumerik are true (24V input).  
Meaning of these inputs:

Table 7-18 X122 digital inputs/outputs

Pin	Signal name	Signal type	Meaning	Default setting
1	DI0	I	Digital input 0 Input ON/OFF1 infeed (if one infeed with a DRIVE-CLiQ connection is operated at the NCU)	x
2	DI1	I	Digital input 1 Input 2. Operating condition OFF3 drives "OFF3 – rapid stop" Braking with a configurable OFF3 ramp (p1135, p1136, p1137); thereafter, pulse suppression and switching on inhibited. The drive stops controlled. The braking response can be set separately for each SERVO.	x

Pin	Signal name	Signal type	Meaning	Default setting
3	DI2	I	Digital input 2 Selection safe standstill group 1 SH/SBC - Group 1 SINAMICS Safety Integrated (SH = p9601 release)	---

### 3.3 Licensing

All needed licenses are provided by Siemens on their [Online Software Delivery \(OSD\)](#) platform. With a valid user and password the licenses can be activated with Siemens Web License Manager. All steps are described well on the platform. Once the licenses are activated, they can be downloaded.

For further information please follow this [link](#).  
Here you can find additional documents:

**SIEMENS**

Web License Manager -

User menu    Contact    -> Internal

**User menu**

- > Direct access
- > Barcode-/multiple assigning
- > Customer login
- > Display license key
- > Manage license pool

**Home**

Update to the Web License Manager 3.0

As of November 1, 2023, the use of the Web License Manager requires authentication with Siemens ID. Register now with Siemens ID: [Siemens ID](#)

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You can learn more about the Web License Manager 3.0 here:

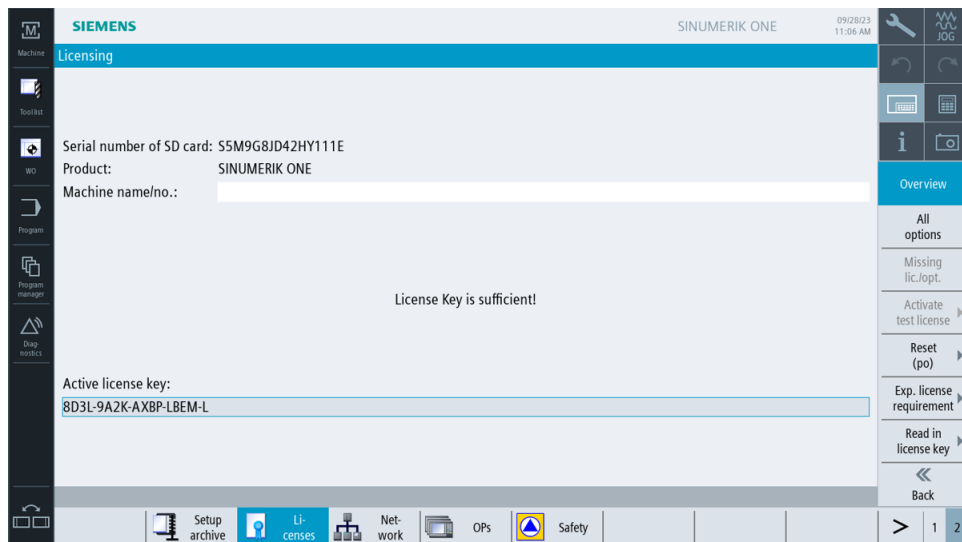
- [SINUMERIK SINAMICS SIMOTION WLM Information V140 EN.pdf](#)
- [EN SINAMICS RT licenses and Web License Manager.pdf](#)
- [DE SINAMICS RT Lizenzen und Web License Manager.pdf](#)
- [Licensing SINUMERIK V100 EN.pdf](#)

The process to download licenses on the Sinumerik ONE are described in this Siemens [documentation](#).

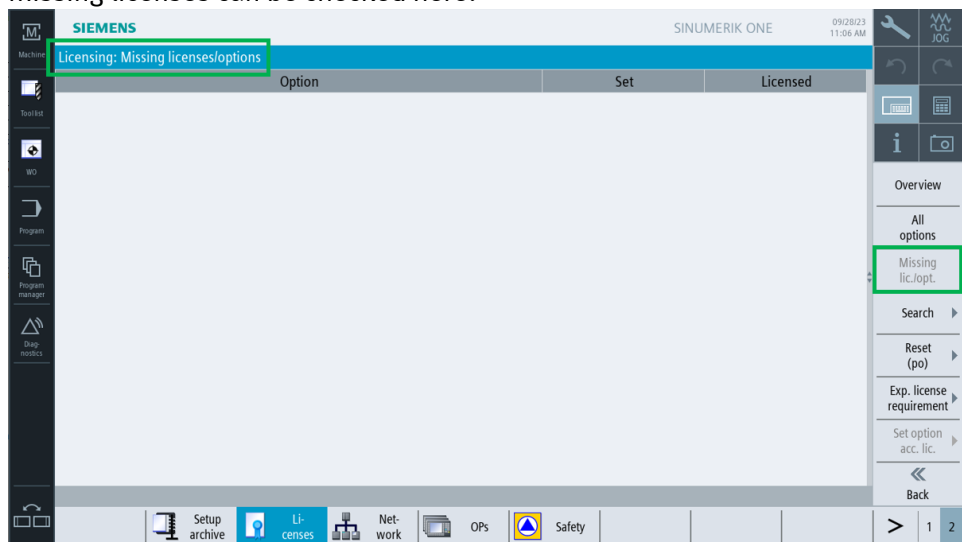
You can check the status of available and needed licenses on the Sinumerik ONE:

Setup menu

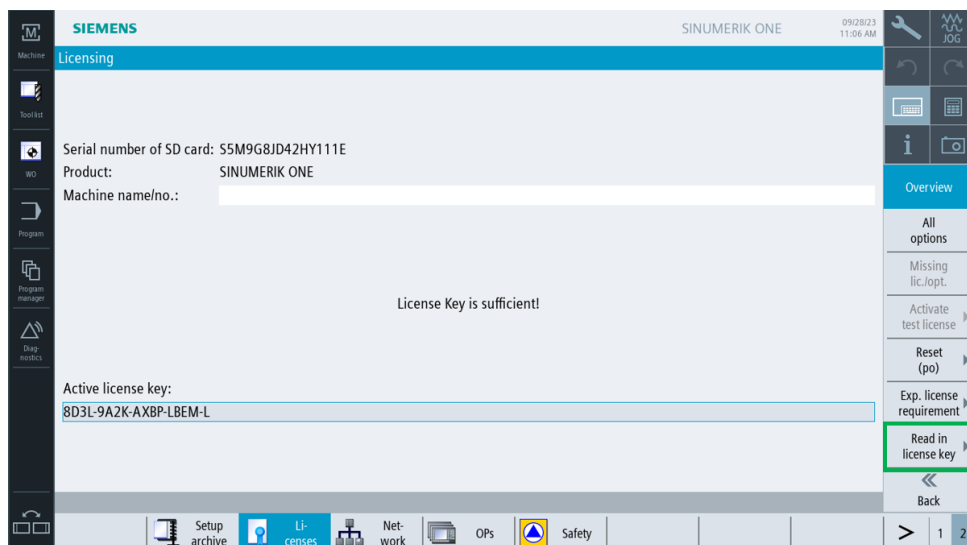
If all needed licenses are activated, you will see the following screen:



Missing licenses can be checked here:



On the same page you will also find the option to read in new licenses. Please follow the steps described in the documentation mentioned above.

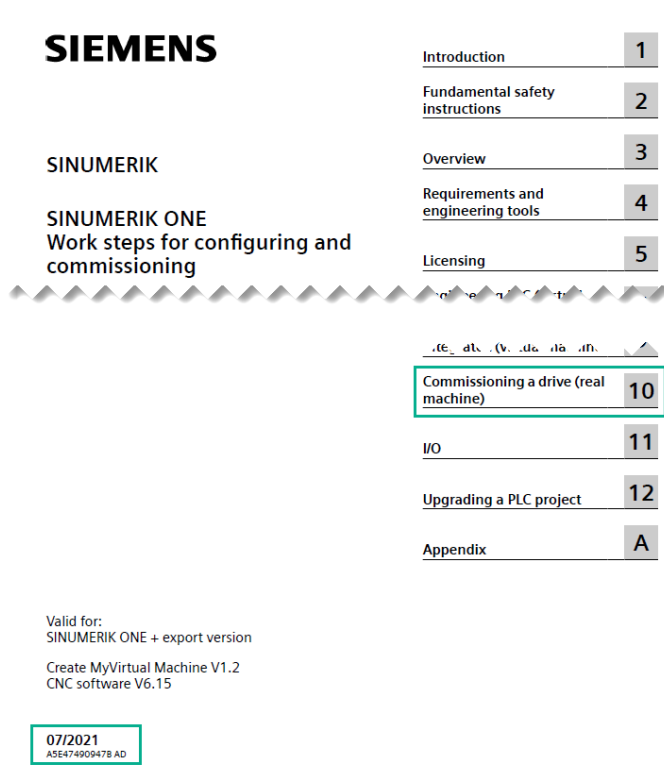




### 3.4 Commissioning with real hardware

The commissioning of the system is done according to a Siemens documentation called [“Sinumerik ONE Work steps for configuring and commissioning”](#).

Version 07/2021 is the last one with a separate chapter regarding commissioning steps of a drive on a real machine.



The image shows the cover page of the Siemens Sinumerik ONE manual. It features the Siemens logo at the top left, followed by the title 'SINUMERIK ONE Work steps for configuring and commissioning'. Below the title is a decorative sawtooth pattern. To the right of the title is a table of contents with chapters 1 through 12 and an Appendix. Chapter 10, 'Commissioning a drive (real machine)', is highlighted with a green border. At the bottom left, there is a box containing the date '07/2021' and the code 'ASE47490H47B AD'.

SIEMENS	Introduction	1
	Fundamental safety instructions	2
SINUMERIK	Overview	3
SINUMERIK ONE	Requirements and engineering tools	4
Work steps for configuring and commissioning	Licensing	5
	Commissioning a drive (real machine)	10
	I/O	11
	Upgrading a PLC project	12
	Appendix	A

Valid for:  
SINUMERIK ONE + export version

Create MyVirtual Machine V1.2  
CNC software V6.15

07/2021  
ASE47490H47B AD

Newer manuals focus only on the virtual machine.

Please follow the given instructions in this manual to commission the Sinumerik ONE.

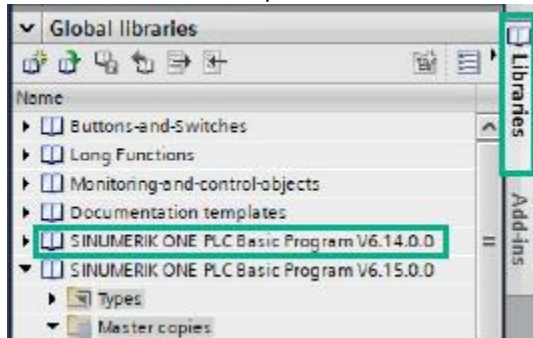
Although the manual focuses on the commissioning with a virtual machine, all steps concerning the PLC part are also identical for the real machine.

At this point only a reference to the most important chapters.

- 4.3 Requirements for a real machine
- 4.4 Software/Hardware of a real machine
- 6 Engineering PLC
- 10 Commissioning a drive (real machine)

Some hints regarding this test system.

- CNC-SW used on the Sinumerik ONE has version 6.15 SP1  
For NC version <6.15 SP2 it is required to use TiA V17 with Toolbox V17.
- Toolbox V17 provides different Sinumerik ONE PLC Basic Program version.  
In this case it was required to use version 6.14.



Each newer version results in a version incompatibility on the Sinumerik ONE.

- Although the test system has a MCP 398C it is possible and required to follow the instruction o using the data types “LBP\_typeMcp483MillingInput” and “LBP\_typeMcp483MillingOutput” to establish a working communication between the Sinumerik and the panel.

MCP			
	Name	Data type	Address
1	MCPIn	"LBP_typeMcp483MillingInput"	%I0.0
2	MCPOut	"LBP_typeMcp483MillingOutput"	%Q0.0

- For the MCP communication we used the default settings.

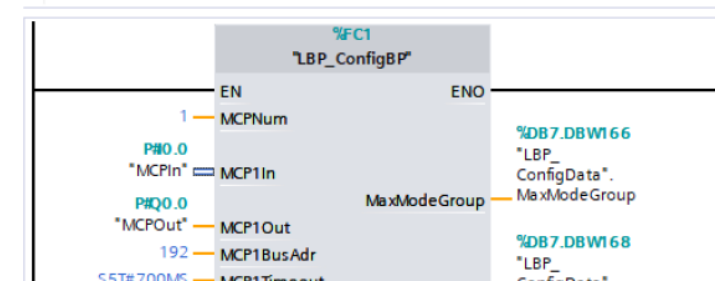
#### MCP set up as IE

You can assign a logical address to the MCP for communication via Ethernet with the 10-bit switch S1.

Table 2-5 Setting of switch S1 as delivered

1	2	3	4	5	6	7	8	9	10	Meaning
off	off	off	off	off	off	on	on	off	off	MCP address 192

So it is an Ethernet based communication on the address 192. This means the setting from the documentation can be taken over:



- AxisEnable function is only called once (See chapter 6.5.7) since we have only one real motor connected.
- The connected motor is configured as an x-axis. There is no spindle axis in this project. Please consider this in chapter 10.

### 3.5 Test the system after configuration and parametrisation.

#### MCP:

If everything is configured correctly, the keys on the MCP stop flashing. Only active keys light up statically.

If they still flash, the communication between the Sinumerik and the MCP is not working. Please check again all settings, hardware and software, and download the project again.

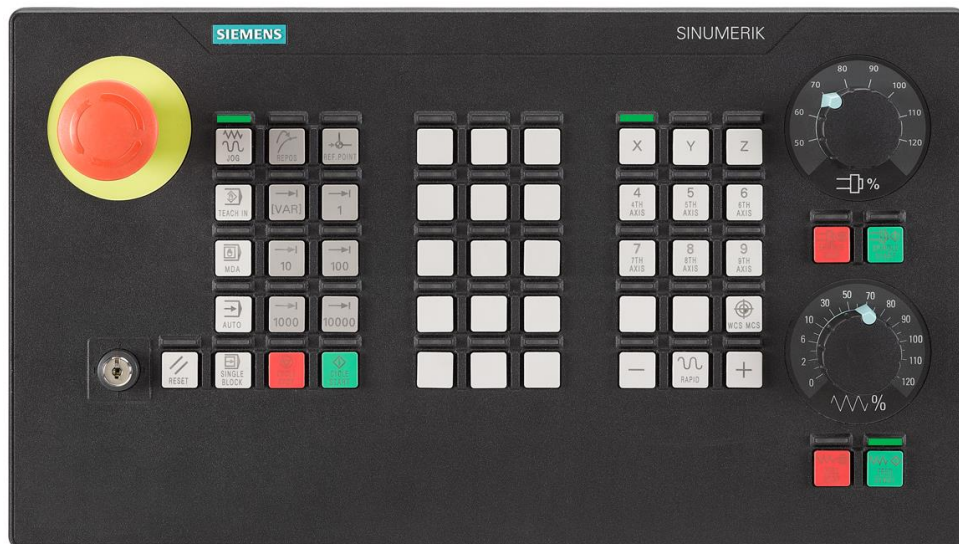
#### Enable and jog motor:

With the described steps in the documentation the system is enabled as soon as all errors are reset.

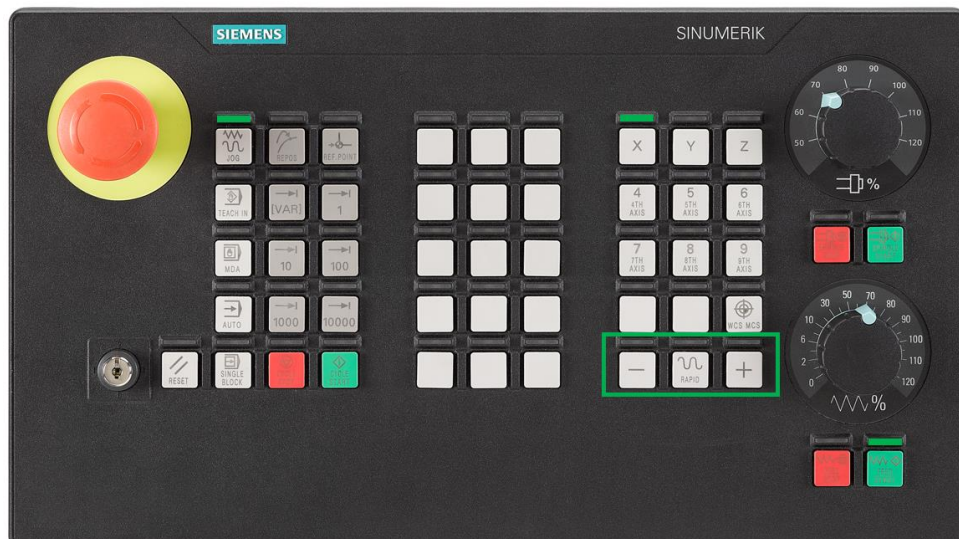
Please check if there are errors present, reset them ("Reset" key on the MCP) and check, if the motor is enabled.

If the used motor has an absolute encoder, like in this case, you should be able to jog the motor now.

Press the keys to get following image:

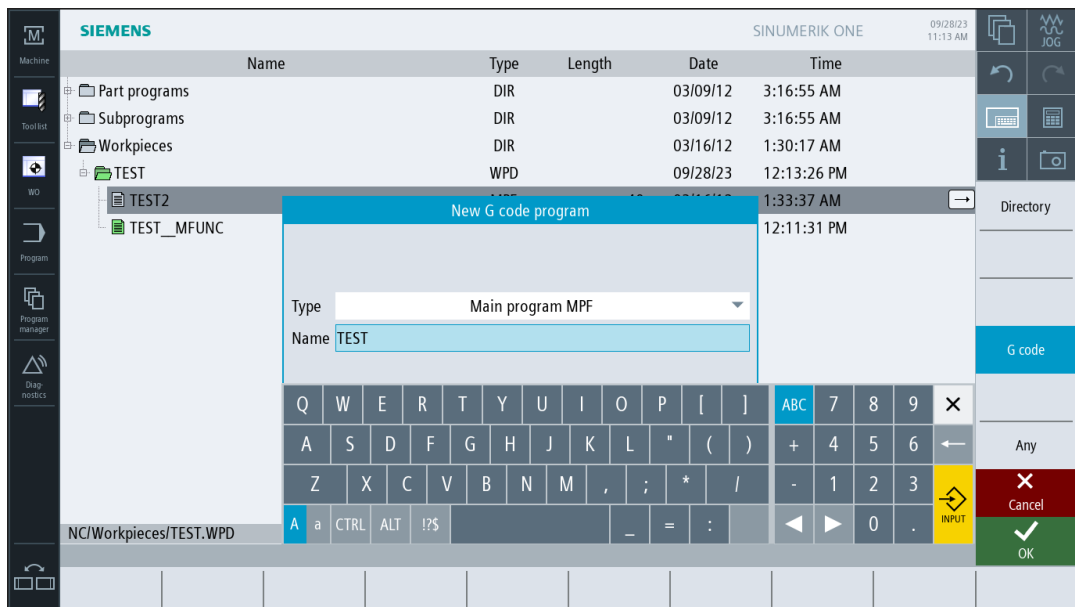
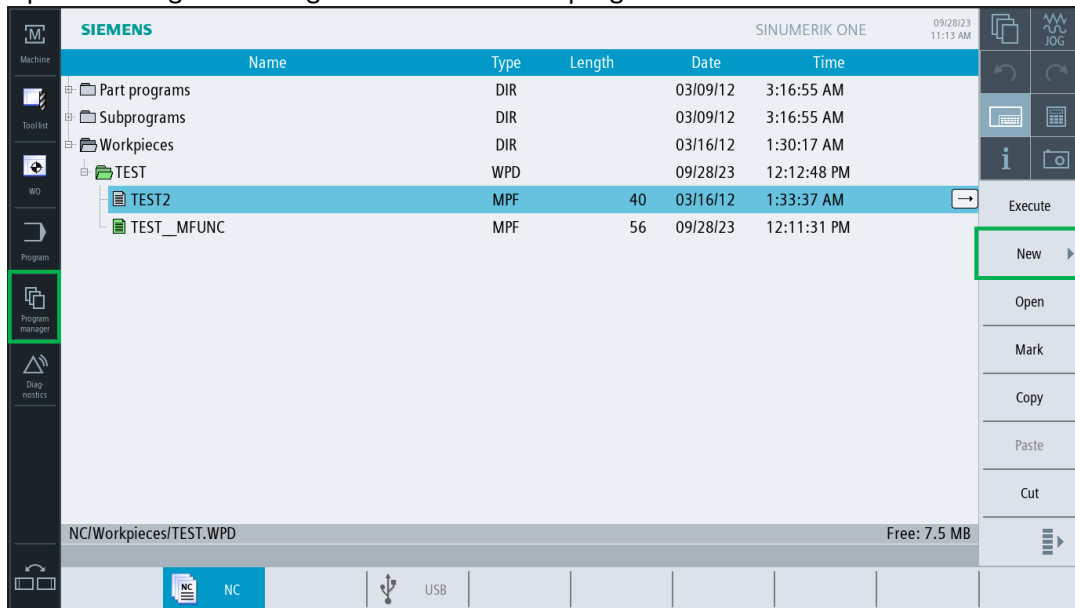


With the following keys the motor can be jogged in positive and negative direction with two different velocities.

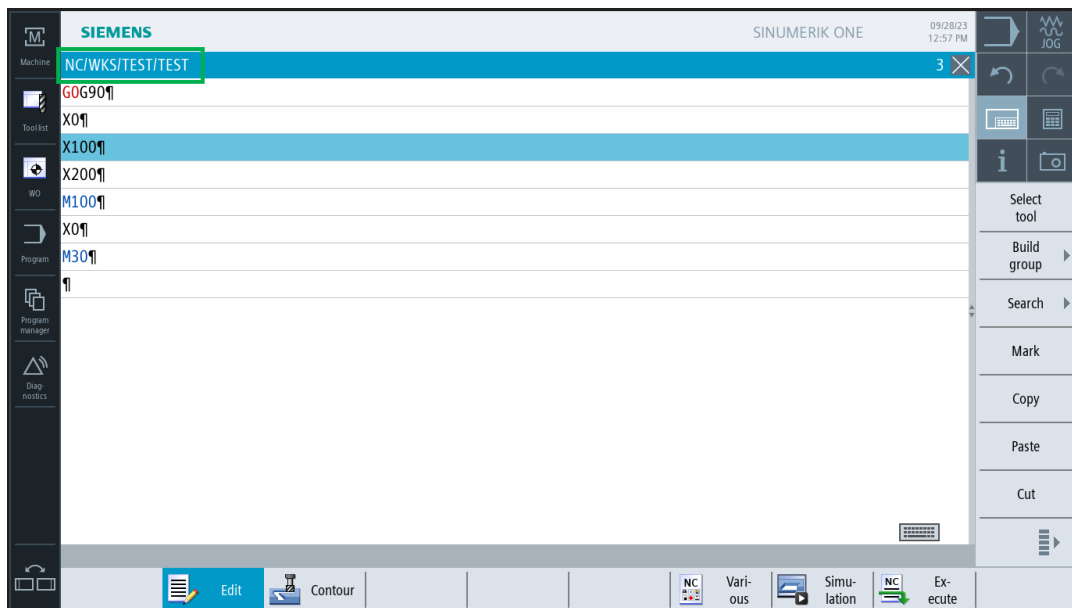


## NC program example

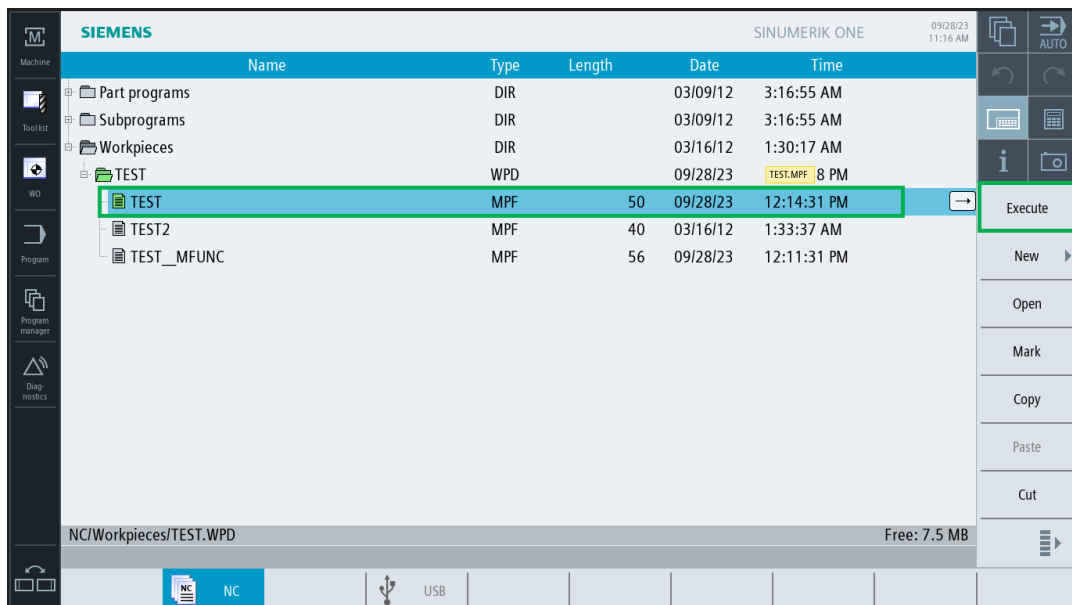
1. Create a new NC program on the Sinumerik.  
Open the Program manager and create a new program.

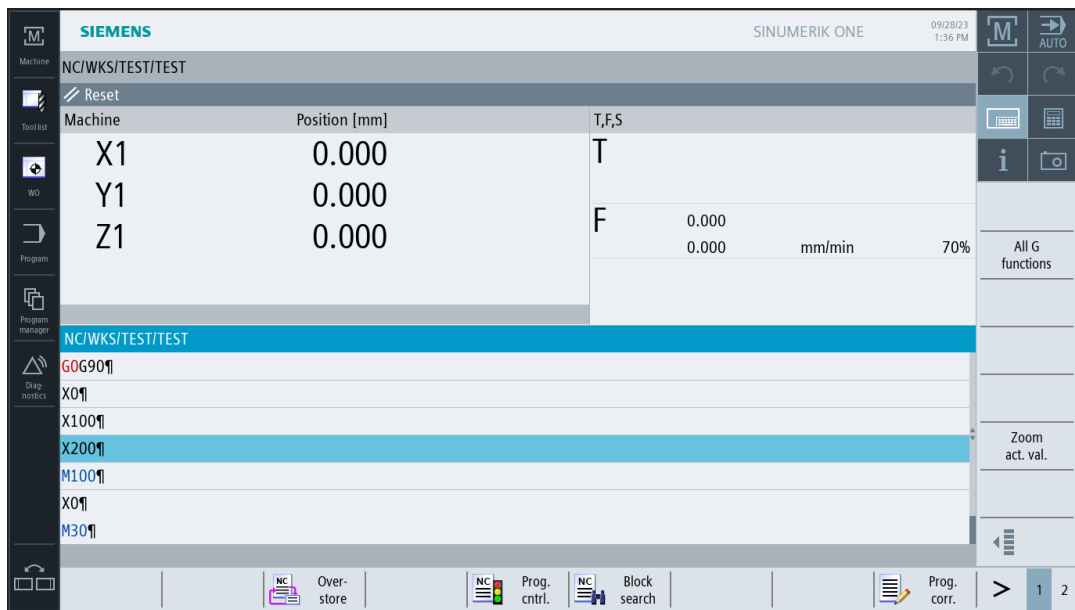


2. Write your program in the editor. The program is saved as soon as you close the editor. The following code shows a movement of the x-axis between three positions. In between there is one M-functions “M100”.

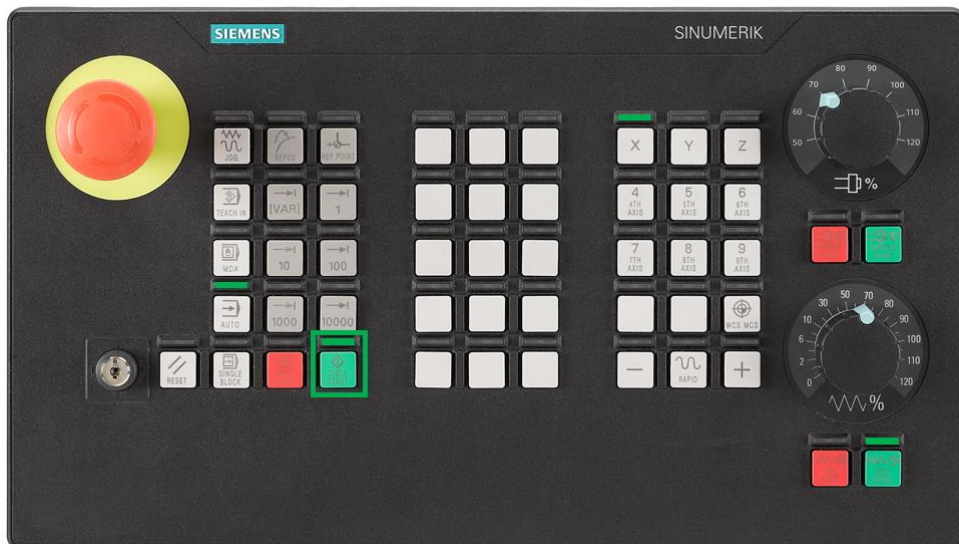


3. Select the new program and load it with “Execute”.





#### 4. Start the program



### 3.6 Handshake between NC program and PLC using M-function

The goal of this chapter is to show a possibility how to handle a handshake between the NC- and PLC-world.

Let's have a look on the created NC-program from the previous chapter:

SIEMENS
NC/WKS/TEST/TEST
G0G90
X0
X100
X200
M100
X0
M30

In this example, the NC program is paused at M-function "M100".

At the same time a PLC program is started. Once this PLC program is finished, the NC program should continue.

So we need a possibility to read the M-function on the PLC side, pause and finally continue the NC-program from the PLC.

Siemens provides a function called "LBP\_CallBackAuxFunc". Using this one it is possible to create such a handshake.

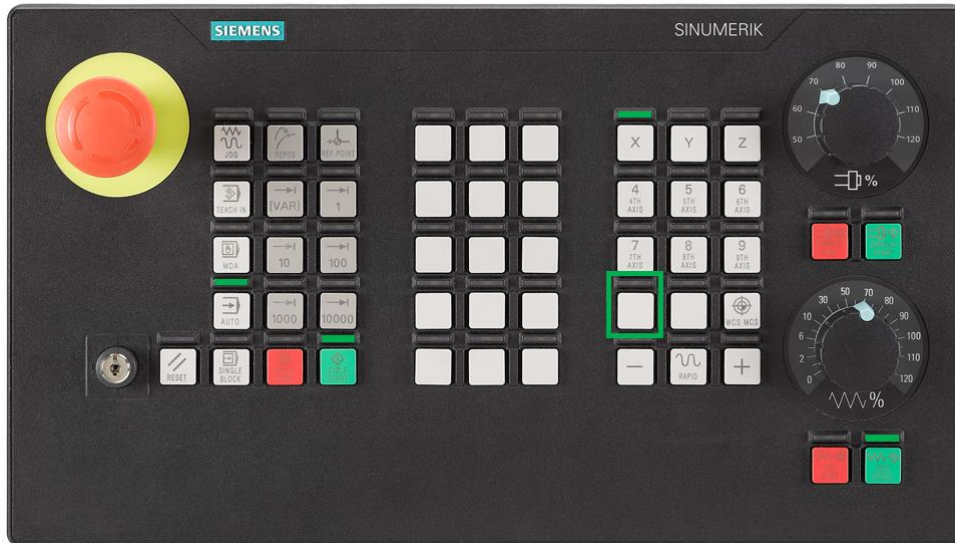
Here is an example code:

```
1  "LBP_CallBackAuxFunc"(Chan := 0);
2
3  CASE #iStep OF
4
5      0: //Check for changes on M-function. If a change is recorded, write M data to variables
6          IF "LBP_Chan1".M1Change THEN
7              #dwM1 := DINT_TO_DWORD("LBP_Chan1".M1);
8              #wExtM1 := INT_TO_WORD("LBP_Chan1".ExtM1);
9              IF #dwM1 = 30 THEN //M30 closes the program. No interruption at this point.
10                 #iStep := 100;
11             ELSE
12                 #iStep := 10;
13             END_IF;
14         END_IF;
15
16
17     10: //Interrupt NC-Code. Wait until confirmation and continue
18         "LBP_Chan1".A_Ridisable := TRUE;
19         //At this point it is possible to call another program, for example a movement controlled by a CMMT (as PLC axis)
20         IF "MCPin".axis10 THEN //Button on MCP "No. 10". Can be also MC signal from an axis movement.
21             "LBP_Chan1".A_Ridisable := False;
22             #iStep := 0;
23         END_IF;
24
25     100:// Do nothing; step back to 0
26         #iStep := 0;
27
28 END_CASE;
```

1. The function "LBP\_CallBackAuxFunc" is called at the beginning.
2. Step 0 checks, if a change on any M-function occurs.  
With a change, it will write two values into local variables.  
In this case only "LBP\_Chan1.M1" is important. It contains the number of the M-function.  
The following IF-ELSE condition checks the number. If it's "M30" it will jump to the last step without any actions.  
In any other cases, it will jump to step 10.



3. Step 10 will now pause the NC-program (LBP\_Chan1.A\_Rldisable := true).  
The user has now the possibility to start any other PLC-program.  
The PLC program and the NC-program will stay in this state until we get an acknowledge to proceed.  
In this case it's the key "no.10" on the MCP.



Once it's pushed, the NC-program will continue, and the PLC-program returns to step 0 waiting for a new M-functions.

### 3.7 Read value from NC in PLC

The idea is to show a possibility how a user can set a variable on the Sinumerik ONE in the NC world, which can then be used in the PLC world for example to change a target position of a drive.

Siemens provides a function block called "LBP\_ReadVar [FB2]".

This function block is described in this [documentation](#) in chapter 11.6.2 with an example using the R variables on the Sinumerik.

Because the needed steps are described well in the documentation, the following part is to show a practical approach.



1. Create a data block for accessing NC variables.  
This step is described in the chapter 11.6.1.2.

NC-VAR-Selector

Project Edit Code Option Help

Softwareversion 4.95

NcData Sinamics

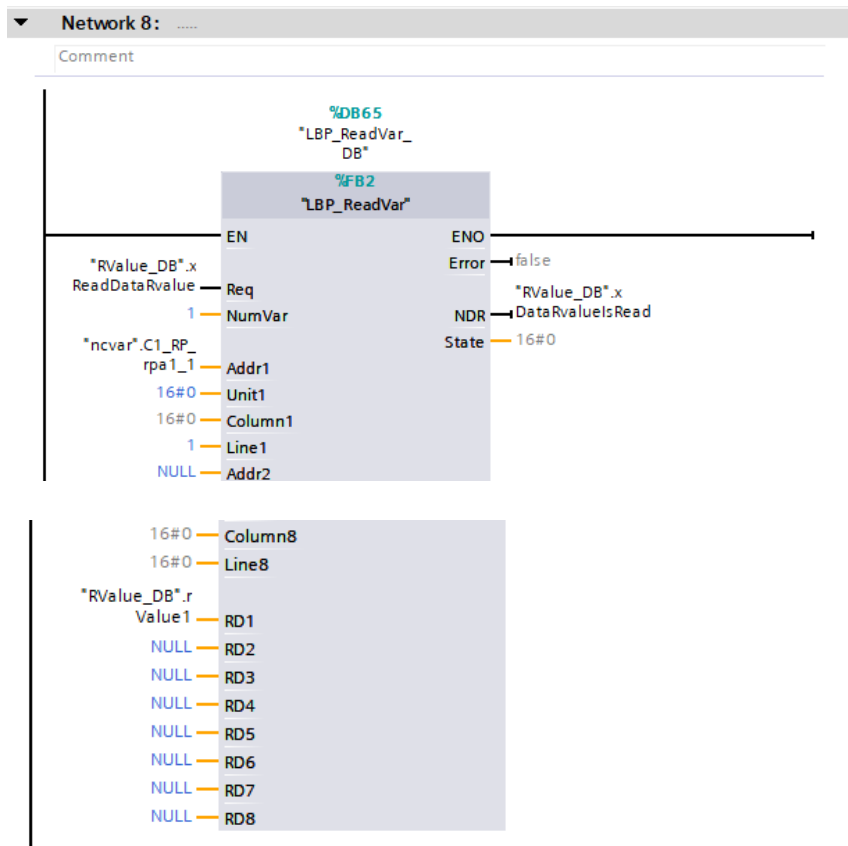
	Area	Component	VariableName	SystemVariableName	Type
238	C[]	PA	declarProtObjectReal[]		REAL
239	C[]	PA	workpieceStatus		INT
240	C[]	PA	fixtureStatus		INT
241	C[]	RP	rpa[]	\$R[x] x = ParameterNo	REAL
242	C[]	S	G0Mode	\$AC_G0MODE	WORD
243	C[]	S	aGG[]	\$A_GG	WORD
244	C[]	S	aLinkTransRate	\$A_LINK_TRANS_RATE	WORD
245	C[]	S	aMonifact	\$A_MONIFACT	REAL
246	C[]	S	aToAckC	\$AC_TC_ACKC	WORD
247	C[]	S	aToCmdC	\$AC_TC_CMDC	WORD

Project: C:\Users\Festo\Documents\Project.var

	Area	Component	VariableName	S7 Alias Name	Type
1	C[1]	RP	rpa[1]	C1_RP_rpa1_1	REAL

In this case we want to have access to the R variables on the Sinumerik ONE.

2. Call the function block LBP\_ReadVar and assign the needed inputs and outputs.



In this case Req, NDR and RD1 are assigned to a DB of a function block, which controls the read process.

Addr1 is assigned to the data block created in step 1.

### 3. Write a program to control the read process.

Example:

```

1 CASE #iStep OF
2   -10:
3     IF #xReadDataRvalue AND NOT #xRunComplete THEN
4       #iStep := 0;
5     END_IF;
6   0:
7     //Read R Variable 1
8     #xReadDataRvalue := true;
9     IF #xDataRvalueIsRead THEN
10      #rRvalue := #rValue1;
11      #iStep := 10;
12    END_IF;
13
14   10:
15     #xRunComplete := true;
16     #iStep := -10;
17 END_CASE;

```

The read date is written to a local variable “rRvalue”.

### 4. R variables can be changed directly on the Sinumerik ONE:

SIEMENS SINUMERIK ONE			
R variables			
R 0	6852	R 15	0
R 1	0	R 16	0
R 2	0	R 17	0
R 3	0	R 18	0
R 4	0	R 19	0
R 5	0	R 20	0
R 6	0	R 21	0
R 7	0	R 22	0
R 8	0	R 23	0
R 9	0	R 24	0
R 10	0	R 25	0
R 11	0	R 26	0
R 12	0	R 27	0
R 13	0	R 28	0
R 14	0	R 29	0
		R 30	0
		R 31	0
		R 32	0
		R 33	0
		R 34	0
		R 35	0
		R 36	0
		R 37	0
		R 38	0
		R 39	0
		R 40	0
		R 41	0
		R 42	0
		R 43	0
		R 44	0

Bottom status bar: Tool list, Tool wear, Work offset, **R User variable**, SD Setting data, 1 2

5. By adapting the previous program (see chapter “Handshake between NC program and PLC using M-function”) we can stop at M function M100. By pushing key no. 10 the read process is started. After variable is read, the NC program can be continued by pushing the tcs key, which basically is the key no. 11 on the panel.

```

1  "LBP_CallbackAuxFunc"(Chan := 0);
2
3  CASE #iStep OF
4
5      0: //Check for changes on M-function. If a change is recorded, write M data to variables
6          IF "LBP_Chan1".M1Change THEN
7              #dwM1 := DINT_TO_DWORD("LBP_Chan1".M1);
8              #wExtM1 := INT_TO_WORD("LBP_Chan1".ExtM1);
9              IF #dwM1 = 30 THEN //M30 closes the program. No interruption at this point.
10                 #iStep := 100;
11             ELSE
12                 #iStep := 10;
13             END_IF;
14         END_IF;
15
16
17     10: //Interrupt NC-Code.
18         "LBP_Chan1".A_RIdisable := TRUE;
19         //here: Read R variable when key no.10 is pushed
20         IF "MCPin".axis10 THEN
21             "RValue_DB".xReadDataRvalue := true;
22         END_IF;
23         //At this point it is possible to start another programm/function, for example a movement controlled by a CMMT (as PLC axis)
24         //Once the variable is read and additionally confirmed by an input (here key "tcs" = "11th" axis) continue the program
25         IF "RValue_DB".xDataRvalueIsRead AND "MCPin".tcs THEN
26             "RValue_DB".xReadDataRvalue := FALSE;
27             "RValue_DB".xRunComplete := false;
28             #iStep := 100;
29         END_IF;
30
31     100:// Reset the interrupt; step back to 0
32         "LBP_Chan1".A_RIdisable := FALSE;
33         #iStep := 0;
34
35 END_CASE;
36

```

The value from the R variable is written to a local variable, which now can be used within the PLC program.

RValue_DB					
	Name	Data type	Start value	Monitor value	Retain
1	Input				
2	rValue1	Real	0.0	6852.0	
3	xRunComplete	Bool	false	TRUE	
4	xDataRvalueIsRead	Bool	false	FALSE	
5	Output				
6	iStep	Int	-10	-10	
7	dwM1	DWord	16#0	16#0000_0000	
8	wExtM1	Word	16#0	16#0000	
9	rRvalue	Real	0.0	6852.0	
10	xReadDataRvalue	Bool	false	FALSE	
11	InOut				
12	Static				