isel NC Intermediate Format

Commands overview

isel **<-->** *automation*

Software manual

B.ZF.11.98/E

7 Overview of the *isel* NC Intermediate Format for Machine Control

NCP file mark

IMF_PBLxxxxxxxxxx
Marks a file as a file in the *isel* intermediate format. This mark stands in the beginning of the first line of the file and is required by the path generator utility program for DC servo motor machines.

Capitalization/ small letters

There is no distinction between the use of small or capital letters.

Axis identifiers

X Y Z A B C
Axis identifiers are X, Y and Z and, moreover, A for the 4th axis, B for the 5th axis and so on.

Comment

;
Starts a comment. The comment includes all characters up to the end of the current line.

Line number

Nxxxxxx
Declaration of a line number of the current NC command. The line numbers may be included for reasons of readability but is not required for the processing with a microstep controller. For the later use of the path data genarator of a servo motor control the line numbers are necessary.

Seperator

Separators between commands and parameters could be whitespaces like blanks or tab signs.

Reference run

REF X (Y Z A ...)
Carries out a reference run of the given axes. The reference run is carried out in the order Z Y X A <other axes> ... If you like to carry out the reference run in another order, simply insert a whitespace character between the different axis identifiers.
Example

REF X	*;carries out a reference run X*
REF XYZ	*;reference run in the order Z Y X*
REF X Y Z	*;reference run in the order X Y Z*
REF X YZA	*;at first reference run X, then in the order Z Y A*

SW limit switch*)

LIMIT Xneg,pos Yneg,pos Zneg,pos Aneg,pos
Definition of software limit switches for the following movements.
After the axe identifiere folows the negative and the positive value for the software limit switch.
The unit of the target position values is micrometer [µm] for linear axes and angular seconds for rotational axes.

*) see page 14

Normal speed

VEL xxx

Sets a normal speet to the value xxx. The normal speed is the segment travel speed when executing one of the commands MOVEABS, MOVEREL, FASTABS, FASTREL, CWABS, CWREL, CCWABS, CCWREL, CWHLXABS, CWHLXREL, CCWHLXABS or CCWHLXREL.
The unit of the speed is micrometer per second [µm/s].

Example

VEL 5000 ;sets the normal speed to 5 mm/s

Rapid speed

FASTVEL xxx

Sets a rapid speed to the value xxx. The fast speed is the segment travel speed when executing one of the commands FASTABS or FASTREL.
The unit of the speed is micrometer per second [µm/s].

Example

FASTVEL 50 00 ;sets the rapid speed to 50 mm/s

Absolute linear normal movement

MOVEABS X... Y... Z... A...

This function carries out an interpolation for up to 4 axes. The axes X, Y and Z carry out a linear interpolation, the axis A executes a synchronized motion. The target position is given as an absolute position relating to the current set workpiece zero point, the parameters X, Y, Z... assign the position values to the corresponding axis. The travel speed is the normal speed set by the command VEL.
The declaration of the target position for each axis is modal, that means, if there is no target position given for an axis, the axis keeps the current position.
The unit of the target position values is micrometer for linear axes and angular seconds [''] for rotational axes (1° = 60‘ = 3600'').

Example

VEL 10000 ;speed 10 mm/s
MOVEABS X20000 Y15000 Z-5000 ;axis XYZ to new position
MOVEABS Y15000 ;only axis Y to new position
other axes keeps the position

Absolute linear rapid movement

FASTABS X... Y... Z... A...

This function carries out a movement with rapid speed. The target position is given as an absolute position relating to the current set workpiece zero point, the parameters X, Y, Z... assign the position values to the corresponding axis. The travel speed is the rapid speed set by the command FASTVEL.
The declaration of the target position for each axis is modal, that means if there is no target position given for an axis, the axis keeps the current position.
The unit of the target position values is micrometer for linear axes and angular seconds for rotational axes.

Relative linear normal movement

MOVEREL X... Y... Z... A...

This function carries out a movement with normal speed.
The behaviour of the axes and the meaning of the parameters is the same as in the command MOVEABS. The target position is given as a position relative to the current position of each axis. The travel speed is the normal speed set by the command VEL.
The declaration of the target position for each axis is modal, that means if there is no target position given for an axis, the axis keeps the current position.
The unit of the target position values is micrometer [µm] for linear axes and angular seconds ['’] for rotational axes (1° = 60‘ = 3600’’).

Example

```
VEL 5000                          ;speed 5 mm/s
MOVEREL X20000 Y15000 Z-5000      ;move of 3 axes
MOVEREL Z-5000                    ;only axis Z 5 mm downwards
```

Relative linear rapid movement

FASTREL X... Y... Z... A...

This function carries out a movement with rapid speed. The behaviour of the axes and the meaning of the parameters is the same as in the command MOVEABS.
The target position is given as a position relative to the current position of each axis. The travel speed is the rapid speed set by the command FASTVEL.
The declaration of the target position for each axis is modal, that means if there is no target position given for an axis, the axis keeps the current position.
The unit of the target position values is micrometer for linear axes and angular seconds for rotational axes.

Example

```
VEL 5000                          ;normal speed 5 mm/s
FASTVEL 35000                     ;rapid speed 35 mm/s
MOVEREL Z5000                     ;axis Z 5 mm upwards
FASTREL X100000 Y100000           ;positioning in XY
```

Circle plane

PLANE XY (XZ, YZ)

This command is used to set the working plane for the circular interpolation by using the commands CWABS, CCWABS, CWREL or CCWREL. It cannot be used to set the working plane for any other kind of movement, e. g. to set the working plane for linear interpolation.
The behaviour of this command is modal. If the working plane is set once, it is valid until the next call up of the function PLANE.

Example

```
PLANE XY                          ;for circular interpolation the axes
                                  ;X and Y are used
CWREL I20000 J0 X0 Y0 Z0 A0       ;circular interpolation
PLANE YZ                          ;Y and Z axes are used
CWREL I20000 J0 X0 Y0 Z0 A0       ;with the same commande
                                  ;Y and Z carry out the circle
```

Absolute circular movement

CWABS / CCWABS I... J... X... Y... Z... A...

This function carries out a circular interpolation on one of the working planes XY, YZ or ZX by using absolute coordinates, that means all declared positions must refer to the set workpiece zero point.
The direction is declared by using the according command (CWABS for movement in clockwise direction, CCWABS for movement in counter clockwise direction). The central point is given with the parameters I and J depending on the current selected working plane (command PLANE).

Working plane	Meaning of I, J
XY	I corresponds to a X-, J to a Y-Coordinate
XZ	I corresponds to a X-, J to a Z- Coordinate
YZ	I corresponds to a Y-, J to a Z- Coordinate

The parameters X, Y, Z, A, ... are used to declare the end position for each axis. They also refer to the set workpiece zero point. If the new target position of an axis is the current position, the declaration of an end position is unnecessary (e. g. when executing a full circle).
If you declare an end position for an axis not used during the circular interpolation, the parameter will be ignored.
The unit of the center position and the target position is micrometer.
The travel speed for the circular interpolation is the normal speed (set by the command VEL).

Example

```
PLANE XY                                    ;set the interpolation plane
MOVEABS X50000 Y50000 Z-2500                ;move to start point
CWABS I75000 J50000 X50000 Y50000 Z-2500    ;circle r = 25 mm

MOVEABS X50000 Y50000 Z-2500                ;this command causes the
CWABS I75000                                ;same movement, but only
                                            ;with the absolutly necessary parameters
```

Relative circular movement

CWREL / CCWREL I... J... X... Y... Z... A...

This function carries out a circular interpolation by using relative coordinates, that means all declared positions refer to the current tool position.
The use of this circle parameter is analogue to the command CWABS with the exception of the use of *relative* positions. The declaration of the parameter is modal, that is, if a relativ end position is 0, this parameter is redundant. If you declare an end position for an axis not used during the circular interpolation, the parameter will be ignored.

Example

```
PLANE XY                                    ;set the interpolation plane
MOVEABS X50000 Y50000 Z-2500                ;move to start point
CWREL I20000 J0 X0 Y0 Z0 A0                 ;circle r = 20 mm

MOVEABS X50000 Y50000 Z-2500                ;this command causes the
CWREL I20000                                ;same movement, but without
                                            ;the redundant parameters
```

Time delay[*)]

WAIT xxxx

This function carries out a time delay during the processing of a NC file. The declaration of the delay time is done in milliseconds [ms]. During the processing of WAIT the time delay can be skiped or stoped, depending on the used controlling program.

Example *WAIT 2000* *;2 seconds delay before continuing*

Set workpiece zero point

WPZERO

The point, at which the tools stands at the moment, is defined as the new workpiece zero point. The old workpiece zero point is deleted. This new workpiece zero point will remain the reference point for all subsequent absolute coordinate data until a new workpiece zero point is defined. There are no parameters to be passed.

Example

```
REF XYZ                    ;reference run
MOVEABS X30000 Y25000      ;move to an absolut position and set
WPZERO                     ;this position as the new WPZERO
```

Set an absolute workpiece zero point

WPZEROABS X.... Y.... Z.... A....

This function sets a new workpiece zero point immediately.

The passed coordinates are absolute values and relate to the machine zero point (the zero point which is normally determined by a reference run). The old workpiece zero point is deleted. This new workpiece zero point will remain the reference point for all subsequent absolute coordinate data until a new workpiece zero point is defined.

If the workpiece zero point for one or more axis(es) shall remain unchanged, just leave out the corresponding parameters.

Example

```
REF XYZ                          ;reference run XYZ
WPZEROABS X5000 Y5000 Z-5000     ;WPZERO set to (X5000,
                                 ;Y5000, Z-5000)
WPZEROABS X35000 Y20000          ;now set to position (X35000,
                                 ;Y20000, Z-5000)
```

Clear workpiece zero point

WPCLEAR

Deletes the current workpiece zero point.

The machine zero point (the zero point which is normally determined by a reference run) serves as new workpiece zero point. This new workpiece zero point will remain the reference point for all subsequent absolute coordinate data until a new workpiece zero point is defined. There are no parameters to be passed.

Example

```
WPCLEAR              ;delete workpiece sero point
```

*) see page 14

Load workpiece zero point

WPREGn X.... Y.... Z.... A....

Loads a workpiece zero point into the workpiece zero point register (for later use). The parameter 'n' is the index of the register.
The passed coordinates are absolute values and relate to the machine zero point (the zero point which is normally determined by a reference run). The diferent workpiece zero points can be activated with WPREGnACT. Depending on the used software program you can manage two or more workpiece zero points.
n = 2 for using PRO-PAL oder PRO-DIN
n = 8 for using REMOTE (servo motor and stepper motor machines)
Example

```
WPREG1 X100000 Y50000 Z-50000     ;register 1 with pos. load
WPREG2 X100000 Y100000 Z-50000    ;register 2 with pos. load
WPREG1ACT                         ;aktivate register 1
MOVEABS X0 Y0 Z0                  ;move to position (0,0,0)
WPREG2ACT                         ;aktivate register 2
MOVEABS X0 Y0 Z0                  ;move to position (0,0,0),
                                  ;position Y is shifted for 50 mm
```

Activate workpiece zero point register*)

WPREGnACT

This funktion aktivates the workpiece zero point, which was loaded in the register 'n'. The parameter 'n' is the index of the desired register. 'n' is a part of the command, so there must not be any spaces in front or behind it.
Example see command WPREGn

Teach workpiece zero point *)

WPTEACH

During the processing a teachbox is opened where you can teach a new workpiece zero point. OK accepts the current position as the new workpiece zero point; ESC keeps the old workpiece zero point.
This command is only available in the REMOTE program (for servo motor and for stepper motor machines).
Example

```
WPCLEAR                 ;delete current workpiece zero point
MOVEABS X0 Y0 Z-0       ;at this position an new workpiece
                        ;zero point is required
WPTEACH                 ;opening of the teachbox
MOVEABS X10000 Y20000   ;processing goes on
MOVEABS Z-15000
```

*) see page 14

Set an output port*) **SETPORT An=v**

The allocation of a physical IO address to a logical address is done in the setup program of the NC driver. The setup of the output channels is necessary for the use of this function.
The parameter 'n' (digit between 1 and 4) indicates the logical address of the output port. The parameter 'v' indicates the value to be set. The format of the output value depends upon the appendix of the parameter.

Example

```
SETPORT A1=100101B      ;set binary value 00100101
SETPORT A1=42D          ;set decimal value 42
SETPORT A1=F2H          ;set hexadecimal value F2
```

Set a single bit*) of an output port **SETBIT An.b**

The allocation of a physical IO address to a logical address is done in the setup program of the NC driver. The setup of the output channels is necessary for the use of this function.
Set a 1-bit output port to the logical value '1'. The parameter 'n' (digit between 1 and 4), indicates the logical address of the output port. The parameter 'b' (value between 1 and 8) indicates the number of the bit to be set.

Example

```
SETBIT A1.4             ;set bit number 4 of output port 1 to '1'
SETBIT A2.1             ;set bit number 1 of output port 2 to '1'
```

Clear a single bit*) of an output port **RESBIT An.b**

The allocation of a physical IO address to a logical address is done in the setup program of the NC driver. The setup of the output channels is necessary for the use of this function.
Set a 1-bit output port to the logical value '0'. The parameter 'n' (digit between 1 and 4), indicates the logical address of the output port. The parameter b (a value between 1 and 8) indicates the number of the bit to be cleared.

Example

```
RESBIT A1.4             ;set bit number 4 of output port 2 to '0'
RESBIT A2.1             ;set bit number 1 of output port 1 to '0'
```

*) see page 14

Wait for bit value*) **WAITBIT Ep.n==v**

Wait for a bit value.
The allocation of a physical IO address to a logical address is done in the setup program of the NC driver. The setup of the output channels is necessary for the use of this function.
The program stops the processing and waits until the defined bit value occurs at the given input port. The parameter 'E' indicates the logical address (digit between 1 and 4) and the bit number (digit between 1 and 8) of the input port to be checked. The parameter 'v' behind '==' is the logical level to be waited for.
For test or controll purpose it is possible to skip or to stof this funktion.
Example

```
MOVEABS X0 Y0                ;processing ...
WAITBIT E1.4==1              ;wait for Bit 4 at port 1 'high'
MOVEABS X20000 Y5000         ;processing goes on ...
```

Wait for bit tamplate*) **WAITPORT Ep==v**

Wait for a bit template at a input port.
The allocation of a physical IO address to a logical address is done in the setup program of the NC driver. The setup of the output channels is necessary for the use of this function.
The program stops the processing and waits until the defined bit template occurs at the given input port. The parameter 'E' indicates the logical address (digit between 1 and 4). The parameter 'v' behind '==' is the 8 bit value to be waited for.
For test or controll purpose it is possible to skip or to stof this funktion.
Example

```
MOVEABS Z0                   ;processing ...
MOVEABS X0 Y0                ;processing ...
WAITPORT E1==00100101B       ;wait for binary value 00100101
or
WAITPORT E1==37D             ;wait for decimal value 37
or
WAITPORT E1==25D             ;wait for hexadecimal value 25
MOVEABS X20000 Y5000         ;processing goes on ...
```

*) see page 14

Begin path processing*)

PATH

Starts the processing of a path data field. Starting and ending the processing of a path data field are internally used functions for a special work mode of the control program.
A path data field or a file with a path data field is generated by a special utility program *of iselautomation*, it is the so called path data generator. You should certainly not generate own path data fields.

End path processing*)

PATHEND

Marks the end of a path data field. Starting and ending the processing of a path data field are internally used functions for a special work mode of the control program.
A path data field or a file with a path data field is generated by a special utility program *of iselautomation*, it is the so called path data generator. You should certainly not generate own path data fields.

Tool change*)

GETTOOL x

This function executes the utility program for automatic tool change. The parameter x specifies the number of the new tool.
Note: Before using this command it is necessary to specify a tool change control program in the setup function of the control program. In addition, the setup of the tool change utility program (for the assignment of changing positions, travel speeds, changing options and so on) has to be executed before using the tool change utility program.

Example

```
MOVEABS Z5000                ;processing ...
FASTABS X5000 Y5000          ;processing ...
COOLANT OFF                  ;cooling pump off
SPINDLE OFF                  ;spindle off
GETTOOL 3                    ;get new tool 3
SPINDLE ON                   ;spindle on
MOVEABS Z10000               ;security hight
FASTABS X150000 Y200000      ;positioning ...
COOLANT ON                   ;cooling pump on
```

*) see page 14

Definition drill cycle*)

DRILLDEF **C**<1> **P**<2> **D**<3> **T**<4> **V**<5> **F**<6> **O**<7> **I**<8> **R**<9> **L**<10> **S**<11>

A drill cycle is defined without executing the drilling. This command is used for setting all parameters for the following command DRILL.
The declaration of the drilling parameters is modal, that means, if a parameter is set it will remain until the next call up.
The declaration of the drilling parameters can be done in one or more lines, e. g. to defin general settings in the beginning of the NC-file and changeable settings before calling up the command DRILL.

parameter	used in cycle	default value	meaning
C		1	Declaration of the drilling cycle: 1 simple drilling 2 peck drilling 3 deburring
P	1,2,3	0	Reference plain, on which refer all parameter of the drilling cycle. The reference plain refer to the workpiece zero point, the value of the Z-coordinate quotes the distance to it. The unit is micrometer [µm]. Sign: positive, if Z-position is above workpiece zero point
D	1,2,3	0	Depth of the borehole in [mm], relative to reference plain. Sign: positive, if movement downwards.
T	1,2,3	0	Time delay for back-off at the end of the hole The unit is milliseconds [ms].
V	1,2,3	1000	Drilling feed rate, the unit is [mm/s]. The rapid speed is given by the command FASTVEL or by the default rapid speed of the setting program
F	2,3	0	First incremental feed rate for drilling and deburring, the unit is [mm]. Sign: positive, if movement downwards.
O	2,3	0	All other incremental feed rates for drilling and deburring, the unit is [mm]. Sign: positive, if movement downwards.
I	2,3	0	Decrease of the incremental feed rate per each cycle. Sign: positive, if incremental feed rate is reduced.
R	3	0	Incremental backtrack for deburring or difference hight for a new run of the last bore depth with rapid speed when peck drilling. The unit is [mm]. Sign: positive, because backtrack value is given.
L	1,2,3	0	Backtrack hight refer to the definied reference plane after the drilling cycle. The unit is [mm]. Sign: positive, if Z-position above the workpiece zero point.
S	1,2,3	0	Relative safety hight, which is defined after the drilling cycle relative to the reference plane. The unit is [mm]. Sign: positive, if Z-position above the workpiece zero point.

Example see command DRILL

Bore*)

DRILL X... Y...

Boreing at the position (X, Y).

All parameters of the drilling cycle have to be set with DRILLDEF before. The parameters X and Y defines the bore position, the unit is micrometer [µm].

Example

```
DRILLDEF P2000          ;reference plane 2 mm above the defined
                        ;workpiece zero point Z
DRILLDEF D20000         ;depth 20 mm relative to reference plane
DRILLDEF T1000          ;time delay at the bottom of the hole 1 second
DRILLDEF V10000         ;feed speed for drilling 10 mm/s
DRILLDEF F7000          ;first drill feed rate is 7 mm
DRILLDEF O5000          ;all other feed rates are 5 mm and
DRILLDEF I1000          ;decrease every cycle for 1 mm
DRILLDEF R1000          ;the incremental backtrack is 1 mm
DRILLDEF L1000          ;backtrack hight relative to reference plane
DRILLDEF S3000          ;safety hight relative to reference plane
DRILLDEF C1             ;aktivate drilling cycle 1, simply drilling
DRILL X10000 Y30000     ;drill at position X = 10 mm, Y = 30 mm
DRILLDEF C2             ;aktivate drilling cycle 2, peck drilling
DRILL X30000 Y30000     ;drill at position X = 30 mm, Y = 30 mm
DRILLDEF C3             ;aktivate drilling cycle 3, deburring
DRILL X50000 Y30000     ;drill at position X = 50 mm, Y = 30 mm
```

Cylinder radius*)

CYL X(Y,Z,A)radius X(Y,Z,A)

Declaration of the cylinder radius in a turning axis.

If you need a intermediate format file for the processing of a cylindrical turning body, you ca use this command. The driver converts the linear velocities on the cylindrical surface into turning velocities.

The first parameter indicates the machine axis (turning axis). In follows the radius of the cylinder. The unit is millimeter.

The second parameter indicates the kartesian axis X, Y oder Z which is replaced from the turning axis.

Note: A circle- or helix-interpolation ist not possible on a cylindrical surface.

To return to the original configuration please input the radius ‘0’, e. g.: CYL A0.

Example

```
CYL A5000 A             ;cylinder radius 5 mm, A is turning axis
```

*) see page 14

Interrupt*)

HALT

Stops the current processing and switches to the mode „single step“. After your intervention, the processing can go on stepwise or continuously.

You can insert a comment in the NC-file, to note all necessary interventions.

Example

```
SPINDLE OFF              ;spindle off
MOVEABS Z5000            ;processing ...
FASTABS X5000 Y5000      ;processing ...
                         ;comment with instructions for the user e. g.
HALT                     ;turn the workpiece 90° to the left
                         ;and then continue processing
MOVEABS Z10000           ;safety hight
FASTABS X15000 Y20000    ;position ...
SPINDLE ON TIME2000      ;spindle on
```

Ramps*)

ACCEL X.... Y... Z.... A....

Adjust the acceleration values of the axes. The unit of the acceleration is percent. The value can be in the range of 5 % ... 100 %.

The maximum acceleration (100 %) is set in the initialisation file.

SPINDLE ON/OFF*)

SPINDLE CW/CCW RPMxxx RPSxxx TIMExxx

This command switches the spindle drive on or off. The parameter CW or CCW declares the turn direction of the spindle. The spindle can be switched on with their default speed by using the parameter ON.

The use of the parameter OFF sets the new spindle speed 0.

To specify a spindle speed by the NC programme it is necessary to use one of the parameters RPM (the speed is given in rounds per minute) or RPS (the speed is given in rounds per second).

You may use either the parameter RPM or the parameter RPS.

The start up delay to accelerate the spindle to the required speed is defined by using the parameter TIME, where xxx is the delay time in milliseconds.

Before using this command it is necessary to specify a spindle control program in the spindle setup function of the control program.

Switch the coolant pump on or off*)

COOLANT ON/OFF

Before using this command it is necessary to assign a output channel in the coolant pump setup function of the control program.

Define tool*)

TOOLDEF Tx Ly Rz

Announce the used respectively the equiped tools.

(For later use)

*) see page 14

Init tool change*) **INITTOOL**

Initialisation of the tool change and of the tool change software. Carry out the tool change initialisation, find out the current configuration, reference runs etc.
(For later use)

End of the NC file **PROGEND**

Stops the processing of the NC file. Depending on the settings made in the control program, the interpreter waits to be restartet or closes the output window automatically and returns to the main input mask of the control program.

Example

```
SPINDLE OFF        ;switch spindle off
COOLANT OFF        ;switch coolant pump off
REF XYZ            ;move axes to definied positions
PROGEND            ;mark end of the program
```

*) This function is not supported by I5EIN, because I5EIN is a setting- and testprogram.

Example for a file in isel intermediate format

This sample file was created with an isel HP/GI converter and shows the milling of a shape.

```
N000001 IMF_PBL_V1.0 - HPREMOTE V1.32 - PP FILE
N000002 ;*********************************************
N000003 ; 3RECTS.NCP Fri Mar 01 12:04:29 1996
N000004 ;*********************************************
N000005 VEL 5000
N000006 FASTVEL 50000
N000007 MOVEABS Z-3000
N000008 VEL 8000
N000009 FASTVEL 50000
N000010 FASTABS X53375 Y0 Z-3000
N000011 MOVEABS Z5000
N000012 VEL 12000
N000013 MOVEREL Y69625
N000014 MOVEREL X67625
N000015 MOVEREL Y-69625
N000016 MOVEREL X-67625
N000017 VEL 10000
N000018 MOVEABS Z-3000
N000019 VEL 5000
N000020 FASTVEL 50000
N000021 FASTABS X30625 Y54000 Z-3000
N000022 MOVEABS Z7000
N000023 VEL 12000
N000024 MOVEREL Y76250
N000025 MOVEREL X72875
N000026 MOVEREL Y-76250
N000027 MOVEREL X-72875
N000028 VEL 10000
N000029 MOVEABS Z-3000
N000030 VEL 5000
N000031 FASTVEL 50000
N000032 FASTABS X0 Y16875 Z-3000
N000033 MOVEABS Z1000
N000034 MOVEREL Y65875
N000035 MOVEREL X61250
N000036 MOVEREL Y-65875
N000037 MOVEREL X-61250
N000038 MOVEABS Z-3000
N000039 PROGEND
```