ILISP documentation

APPS for CAD/CAM/NESTING on waterjet cutting machines

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Postprocessor events

ARC CHABRASIVE CHMODE CHPRESSURE HEADER LINE PART QUALITY STOP TOOLUP TOOLDOWN TEXT

$CARC

This function will add geometry for an arc that are less than 180 degree.

($CARC <xtarget> <ytarget> <radius> <ccw> <speed>)

The function will add movements for a circulat movement in the CNC-file

$CCIRCLE

This function will add geometry for a 360 degree circular movement in the CNC-file.
The first segment is 190 degree and next segment is 170 degree.

($CCIRCLE <idist> <jdist> <speed>)

The IDIST argument the distance to the circle center in X and JDIST is the relative distance to circle center in Y (In IGEMS coordinate system).
Speed is the cutting speed in mm/min.
The movements generated by the $CCIRCLE function do not handled by the simulation system.

$CLINE

This function will add geometry for a linear movement in the CNC-file.

($CLINE <xdist> <ydist> <speed>)

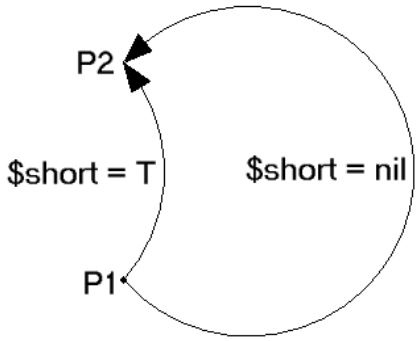
The XDIST argument is the relative distance from current position to the end if the line in X and the YDIST argument is the distance in Y.
The movements generated by the $CLINE function do not handled by the simulation system.

ARC

This event handles the circular movements. If you do not include a function for this event then the movement will be done LINE vectors.
Following variables can be included in the postprocessor to overwrite existing machine setup settings:
LargestSegmentAngle
MaxRadius

The function can use following variables:

$a	Real	The angle in radians of the major axis. If no 5-axis equipment are in use this variable is always 0. The value is transformed to the actual kinematic.
$amotor	Real	The angle in radians of the major axis. The value is always in motor degree.

$ab	Bool	T if the movement have any A or B information else nil.
$b	Real	The angle in radians of the minor axis. If no 5-axis equipment are in use this variable is always 0
$bmotor	Real	The angle in radians of the minor axis. The value is always in motor degree.
$c	Real	The angle in radians of the 6th axis. If no rotation unit are in use this variable is always 0.0
$f	Real	Cutting speed (this value can normally be used)
$fe	Real	The cutting speed at the end of the arc.
$flag	Int	This is a bit value with following meaning: 1=Belongs to a lead-in 2=Belongs to a lead out 4=Belongs to marking 8=Belongs to circular piercing 16 32
$fs	Real	The cutting speed at the start of the arc.
$i	Real	Circle center in X (the value can be in absolute or incremental mode depending on the geometry settings in the machine setup).
$Iabs	Real	Circle center in X
$Irel	Real	Circle center in X relative from arc start point
$j	Real	Circle center in Y (the value can be in absolute or incremental mode depending on the geometry settings in the machine setup.
$Jabs	Real	Circle center in Y
$Jrel	Real	Circle center in Y relative from arc start point
$last	Bool	This variable is T if this is the last movement on the contour
$len	Real	The length of the arc
$r	Real	The radius of the movement. On many controllers this value can be used for circular movements with an included angle less than 180 degree
$segment	Real	The segment angle of the arc. The value is positive for CCW and negative for CW.
$short	Bool	 The variable is T if the move describe the shorter alternative else nil.

$slope	Real	The max cutting angle at this position. Vertical is 0.0 The angle is caclulated in the vector direction as radians.
$vector	list	A list of three values that describe the direction of the jet. Example: (0 0 -1)
$x	Real	The endpoint in X (the value is transformed according to the Axis direction setting in the Machine Setup).
$xm	Real	The midpoint of the arc in X. This is the standard method for robot programming of arcs
$y	Real	The endpoint in Y (the value is transformed according to the Axis direction setting in the Machine Setup).
$ym	Real	The midpoint of the arc in Y. This is the standard method for robot programming of arcs
$z	Real	The z-value for the tool refer to table, thickness or highest position. This can be set in the machine setting.
$zref	Int	This variable is nil if no pre-measuring tool are used. In other case it's an integer that refer to that measure point that are measured by the MEASURE function.

Example 1:
This example is working on almost all machines.

```
(DEFUN arc ()
 (IF $ccw
  (WRITE (STRCAT (NTXT) "G03 X" (RTS $X) " Y" (RTS $Y) " I" (RTS $I) " J" (RTS $J) " F" (RTF $f)))
  (WRITE (STRCAT (NTXT) "G02 X" (RTS $X) " Y" (RTS $Y) " I" (RTS $I) " J" (RTS $J) " F" (RTF $f)))
 )
)
```

Example 2:
This example use the R (radius) if the included angle is less than 180 degree

```
(DEFUN arc ()
 (COND
  ((AND $ccw $short)
   (WRITE (STRCAT (NTXT) "G03 X" (RTS $X) " Y" (RTS $Y) " R" (RTS $R) " F" (RTF $f))))
  ($ccw
   (WRITE (STRCAT (NTXT) "G03 X" (RTS $X) " Y" (RTS $Y) " I" (RTS $I) " J" (RTS $J) " F" (RTF $f))))
  ((AND (NOT $ccw) $short)
   (WRITE (STRCAT (NTXT) "G02 X" (RTS $X) " Y" (RTS $y) " R" (RTS $R) " F" (RTF $f))))
  (T
   (WRITE (STRCAT (NTXT) "G02 X" (RTS $X) " Y" (RTS $Y) " I" (RTS $I) " J" (RTS $J) " F" (RTF $f))))
 )
)
```

Example 3:
This is a more compact example that make the same result as Example 2

```
(DEFUN arc ()
 (WRITE (STRCAT (NTXT) (IF $ccw "G3 X" "G2 X") (RTS $x) " Y" (RTS $y)
  (IF $short (STRCAT " R" (RTS $r)) (STRCAT " I" (RTS $i) " J" (RTS $j))) " F" (RTF $f)))
)
```

CHBARGRAM

This event controls the cutting pressure and the abrasive amount in a waterjet cutting system. In many cases the pressure and the abrasive amount are changed at the same time, of this reason we have put this two different options in the same function.

Following variables are available:

$bar	Int	The pressure in bar.
$barrel	Int	The pressure difference between old and new pressure. The value is positive on increased pressure else negative.
$bleed	Bool	T if the pump has a bleed valve to reduce the pressure, else this variable is nil.
$chbar	Bool	T if the bar should be changed else the variable is nil.
$chgram	Bool	T if the amount of abrasive should be changed else the variable is nil.
$clean	Bool	T if the nozzle must be cleaned before marking else nil. This is only happen if abrasive has been used and the nozzle now should be use for marking without abrasive. The Rapid function has already moved the nozzle to a good X, Y position for cleaning.
$delay	Real	Delay time for the pump to reduce or increase the pressure.
$gram	Int	The amount of abrasive per minute. If no abrasive should be used than the value is 0.
$gramrel	Int	The different between the amount of gram used before and the new value. The value is positive if the amount of abrasive is increasing and negative if the amount of abrasive is reducing.
$high	Bool	This variable is only needed if the pressure can be controlled in two steps ($variable=nil). $high is T if the pressure is the highest else it's nil.
$init	Bool	If it's the first initialization of the pressure or abrasive amount then the variable is T else it's nil.
$lbs	Real	The amount of abrasive per minute. If no abrasive should be used then the value is 0. ($lbs = $gram /453.5934).
$msg	String	An automatic generated text string that can be added to the CNC-file as a comment. The different text can be: When starting the pump: "PUMP ON". When changing pressure and abrasive amount at the same time: "BAR:nnn GRAM nnn". When changing only the pressure: "BAR:nnn". When changing only the abrasive amount "GRAM:nnn".
$psi	Int	The pressure in PSI ($psi = $bar*14.50326).
$reason	Int	1. Start pump, manually pressure. 2. Start pump in high/low pressure. 3. Start pump in variable pressure. 4. Change variable pressure. 5. Change high/low pressure. 6. Change variable pressure and variable abrasive. 7. Change high/low pressure and variable abrasive. 8. Change variable abrasive. 9. Turn off pump. 10. Change pressure and abrasive manually. 11. Change pressure manually. 12. Change abrasive manually.

$reduce	Bool	T if the pressure should be reduced by opening the jet. The Rapid function has already moved the nozzle to a good X, Y position to reduce the pressure. If the machine has a bleed valve then this variable always nil.
$variable	Bool	T if the pressure is variable controlled, nil if the pressure can be controlled in two step.

Note! This function is not used as a main switch for if abrasive should be used or not.

Example: When changing between marking with pure water and cutting with abrasive. In that case use the variable $useabr that are available in the PIERCING and CUTOFF functions.

In the example we have just take some randomly codes. They have following meaning:

M70 Start pump, M71 Pump off, M72 Decrease pressure, M73 Increase pressure, M74 Low pressure, M75 High Pressure, S Abrasive amount in gram,

P Pressure in bar.

Example:

```
(DEFUN chbargram ()
 (COND
  ((= $reason 1)
   (WRITE (STRCAT (NTXT) "M70 (START PUMP)")))
  ((= $reason 2)
   (WRITE (STRCAT (NTXT) (IF $high "M75 (SET HIGH PRESSURE)" "M74 (SET LOW PRESSURE)")))
   (WRITE (STRCAT (NTXT) "M70 (START PUMP)")))
  ((= $reason 3)
   (WRITE (STRCAT (NTXT) "P" (ITOA $bar) " (SET " (ITOA $bar) " BAR)"))
    (WRITE (STRCAT (NTXT) "M70 (START PUMP)")))
  ((= $reason 4)
   (WRITE (STRCAT (NTXT) "P" (ITOA $bar) " (SET " (ITOA $bar) " BAR)"))
   (WRITE (STRCAT (NTXT) (IF (MINUSP $barrel) "M72 (DECREASE PRESSURE)" "M73 (INCREASE PRESSURE)")))
   (DELAY $delay))
  ((= $reason 5)
   (WRITE (STRCAT (NTXT) (IF $high "M75 (SET HIGH PRESSURE)" "M74 (SET LOW PRESSURE)")))
   (DELAY $delay))
  ((= $reason 6)
   (WRITE (STRCAT (NTXT) "S" (ITOA $gram) " (SET " (ITOA $gram) " GRAM)"))
   (WRITE (STRCAT (NTXT) "P" (ITOA $bar) " (SET " (ITOA $bar) " BAR)"))
   (WRITE (STRCAT (NTXT) (IF (MINUSP $barrel) "M72 (DECREASE PRESSURE)" "M73 (INCREASE PRESSURE)")))
   (DELAY $delay))
  ((= $reason 7)
   (WRITE (STRCAT (NTXT) "S" (ITOA $gram) " (SET " (ITOA $gram) " GRAM)"))
   (WRITE (STRCAT (NTXT) (IF $high "M75 (SET HIGH PRESSURE)" "M74 (SET LOW PRESSURE)")))
   (DELAY $delay))
  ((= $reason 8)
   (WRITE (STRCAT (NTXT) "S" (ITOA $gram) " (SET " (ITOA $gram) " GRAM)")))
  ((= $reason 9)
   (WRITE (STRCAT (NTXT) "M71 (TURN OFF PUMP)")))
  ((= $reason 10)
   (WRITE (STRCAT (NTXT) "M00 (SET " (ITOA $bar) " BAR " (ITOA $gram) " GRAM)")))
  ((= $reason 11)
   (WRITE (STRCAT (NTXT) "M00 (SET " (ITOA $bar) " BAR)")))
  ((= $reason 12)
   (WRITE (STRCAT (NTXT) "M00 (SET " (ITOA $gram) " GRAM)")))
 )
)
```

If the machine must reduce the pressure then the variable $reduce is T. If the machine should change from using abrasive to marking without abrasive then the variable $clean I T.

If you want to move the jet to a position that earlier has been used as piercing position and at that point open the jet for cleaning or for reducing the pressure then you can call a predefined function called CleanAndReduce
Example:

(IF (OR (AND $reduce (NOT $bleed)) $clean) (CleanAndReduce))

The CleanAndReduce function will use a series of instructions RAPID, JETDOWN, PIERCING, DELAY, CUTOFF and JETUP.

CHMODE

This event is called in the beginning of the CNC-file initialize a working mode. The event is called every time the machine change working mode and the event can be used to initialize different options in the machine.
Following variables can be used:

$mold	Int	The variable handle the previous working mode nil=First time the event is called, this variable is always nil. 0=End of measure mode. 1=End of drilling mode. 2=End of marking mode. 3=End of pre-piercing mode. 4=End of cutting mode. 5=End of inkjet marking mode. 6=End of special marking mode.
$mode	Int	The variable means following. 0=Start measure mode. 1=Start drilling mode. 2=Start marking mode. 3=Start pre-piercing mode. 4=Start of cutting mode. 5=Start of inkjet marking mode. 6=Start of special marking mode.

Example:

```
(DEFUN chmode ()
 (COND
  ((NOT $mold) nil)
  ((= $mold 0) (WRITE (STRCAT (NTXT) "(END OF MEASURE SECTION)")))
  ((= $mold 1) (WRITE (STRCAT (NTXT) "(END OF DRILLING SECTION)")))
  ((= $mold 2) (WRITE (STRCAT (NTXT) "(END OF MARKING SECTION)")))
  ((= $mold 3) (WRITE (STRCAT (NTXT) "(END OF PRE-PIERCING SECTION)")))
  ((= $mold 4) (WRITE (STRCAT (NTXT) "(END OF CUTTING SECTION)")))
  ((= $mold 5) (WRITE (STRCAT (NTXT) "(END OF INKJET MARKING SECTION)")))
  ((= $mold 6) (WRITE (STRCAT (NTXT) "(END OF SPECIAL MARKING SECTION)")))
 )
 (COND
  ((= $mode 0) (WRITE (STRCAT (NTXT) "(START OF MEASURE SECTION)")))
  ((= $mode 1) (WRITE (STRCAT (NTXT) "(START OF DRILLING SECTION)")))
  ((= $mode 2) (WRITE (STRCAT (NTXT) "(START OF MARKING SECTION)")))
  ((= $mode 3) (WRITE (STRCAT (NTXT) "(START OF PRE-PIERCING SECTION)")))
  ((= $mode 4) (WRITE (STRCAT (NTXT) "(START OF CUTTING SECTION)")))
  ((= $mode 5) (WRITE (STRCAT (NTXT) "(START OF INKJET MARKING SECTION)")))
  ((= $mode 6) (WRITE (STRCAT (NTXT) "(START OF SPECIAL MARKING SECTION)")))
 )
)
```

The variables $mold and $mode remains unchanged. This means that the value can be used by other functions.

CHTOOL

The CHTOOL function is used for changing active cutting tool or/and change the distance between the tools.
The function will never be called if the machine has only one tool.
Following variable can be used:

Variable	Type	Description
$activectrl	Bool	If the control of active tools can be handled by the CNC then this variable is T. If the distance must be handled manually then the variable is nil.
$chactive	Bool	T if active tool should be changed else the variable is nil.
$chdist	Bool	T if the distance between tools should be changed, else this variable is nil
$distctrl	Int	If the distance between each tool can be handled by the CNC then this variable is T. If the distance must be handled manually then the variable is nil.
$feed	real	Speed for the tool distance change on the cross beam in mm/min
$index	Int	Increasing value that starts on 0 and is increased by 1 for each tool change
$maxdist	real	Maximum distance between the tools
$maxtools	int	Number of tools on this machine.
$mindist	real	Minimum distance between the tools
$msg	String	An automatic generated text with information of tool distances and active tools.
$msgactive	String	An automatic generated text message with information about active tools.
$msgdist	String	An automatic generated text message with information about distance between tools
$offset	Real	Normally all coordinates refer to the first Tool. If this tool is not in use then this value contains the distance to the first used tool.
$pack	Bol	If the outermost not used tools should be packed as closed as possible. This will increase the active cutting area on the machine.
$parking	Bol	If tools that are not in use should be parked in a non moving position at the very end of the cross beam. nil=Do not park, T=Park.
$reason	Int	1=Flag for Skip tool init" This is the first tool initialization. This flag is 1 if it's the tool initializing and if tool nr 1 is used in that case. If you start with more than one tool then this flag is not 1. 2=Change active tool manually. 3=Change active tool by CNC. 4=Change distance between tool manually. 5=Change distance between tool by controller. 6=Change distance and active tool manually. 7=Change distance manually and active tool by CNC. 8=Change distance by CNC and active tool manually. 9=Change distance and active tool by CNC.
$skip	Bool	If the toggle "Skip tool init" is activated.
$tooldist	real	Distance between each activated used cutting tool.
$toollist	List	A list of distances between each tool.

$tools	Int	A bit coded value that controls what tools should be active (ON). 1=T1 2=T2 4=T3 8=T4 16=T5 32=T6 64=T7 128=T8 The summary of the value controls active tools. Example: 11=(1+2+8)=T1+T2+T4
$x	Real	First coordinate that will be used after the CHTOOL function.
$y	Real	First Y coordinate that will be used after the CHTOOL function.

Example 1:
In this example we use the $reason variable to handle all options. $reason 8 and 9 is calling recursive to avoid writing the same information more than one time.

```
(DEFUN chtool (/ txt ddress dist count)
 (COND
  ((= $reason 1) ; Tool initialization
   (WRITE (STRCAT "(TOOL INITIALIZON IS SKIPPED)")))
  ((= $reason 2) ; Change active tools manually
   (WRITE (STRCAT (NTXT) "M00 (" $msgactive ")")))
  ((= $reason 3) ; Change active tools by CNC
   (WRITE (STRCAT (NTXT) "T" (ITOA $tools) " (" $msgactive ")")))
  ((= $reason 4) ; Change distance between tools manually
   (WRITE (STRCAT (NTXT) "M00 (" $msgdist ")")))
  ((= $reason 5) ; Change distance between tools by CNC
   (SETQ txt "M50")
   (SETQ address (LIST " #100=" " #101=" " #102=" " #103="))
   (SETQ count 0)
   (WHILE (SETQ dist (NTH count $toollist))
    (SETQ txt (STRCAT txt (NTH count address) (RTS dist)))
    (SETQ count (1+ count))
   )
   (WRITE (STRCAT (NTXT) txt " (" $msgdist ")")))
  ((= $reason 6) ; Change distance and active tools manually
   (WRITE (STRCAT (NTXT) "M00 (" $msg ")")))
  ((= $reason 7) ; Change distance manually and active tool by CNC
   (WRITE (STRCAT (NTXT) "M00 (" $msgdist ")"))
   (WRITE (STRCAT (NTXT) "T" (ITOA $tools) " (" $msgactive ")")))
  ((= $reason 8) ; Change distance by CNC and active tool manually
   (SETQ $reason 5)
   (CHTOOL)
   (SETQ $reason 2)
   (CHTOOL))
  ((= $reason 9) ; Change distance and active tool by CNC
   (SETQ $reason 5)
   (CHTOOL)
   (SETQ $reason 3)
   (CHTOOL))
 )
)
```

Example 2:
This example has the same functionality, but use other variables.

CleanAndReduce

This function generates a movement, open the jet for cleaning or for reducing the pressure. Se the function CHBARGRAM for more information.

CUTOFF

This event should always be added to the postprocessor. It turns of the cutting and the marking (if the cutting tool is used for marking).

The function can use following variables:

$chkerf	Bool	This variable is T if the kerf should be changed else this variable is nil
$delay	Real	This variable controls the delay between abrasive and water off.
$kerf	Int	If $chkerf is T then the variable handle what the kerf should be changed to. If $chkerf is nil then the variable shows the actual kerf. 0=No kerf (G40), 1=Right side (G41), 2=Left side (G42)
$lowatoff	Bool	T if next piercing should be in low pressure else nil.
$marking	Bool	The variable is T if the cutoff belongs to a marking else this variable is nil
$time	Real	Delay time after the jet has been turned off.
$tools	Int	A bit coded value that controls what tools should be activated or deactivated.
$useabr	Bool	This variable is T if abrasive is used else this value is nil.
$wacode	Bool	This variable is T the controller is using different codes for abrasive and water off.

Sample 1

```
(DEFUN cutoff()
 (WRITE (STRCAT (NTXT) (IF $marking "(MARKING OFF)" "(CUTTING OFF)")))
 (IF (AND $useabr $wacode)
  (PROGN
   (WRITE (STRCAT (NTXT) "M7" (MSG "(ABRASIVE OFF)")))
   (DELAY $delay))
 )
 (WRITE (STRCAT (NTXT) "M5" (MSG "(WATER OFF)")))
 (DELAY $time)
 (IF $chkerf (WRITE (STRCAT (NTXT) "G4" (ITOA $kerf))))
)
```

Sample 2:

```
(DEFUN cutoff()
 (IF (> (LOGAND $tools 1) 0) (WRITE (STRCAT "SETBIT A2.1=1"))) ;Turn Off Jet 1
 (IF (> (LOGAND $tools 2) 0) (WRITE (STRCAT "SETBIT A2.2=2"))) ;Turn Off Jet 2
 (IF (> (LOGAND $tools 4) 0) (WRITE (STRCAT "SETBIT A2.3=3"))) ;Turn Off Jet 3
 (IF (> (LOGAND $tools 8) 0) (WRITE (STRCAT "SETBIT A2.4=4"))) ;Turn Off Jet 4
 (DELAY $time)
)
```

DATAPOINT

The Datapoints can be entered from the CAM tab in 3D-5X it has a similar function as the Ref pos command, but the datapoint don't have any relation to the toolpath. The function will be called in the beginning of the postprocessing just after the Header command. It will be called one time for each entered datapoint.

$attrib	Text	The attribute of the datapoint
$x	Real	The position in X
$y	Real	The position in Y
$z	Real	The position in Z

$vector	List	The direction of the vector

```
(DEFUN datapoint ()
 (WRITE (STRCAT (NTXT) "(DATAPOINT:" $attrib " X" (RTS $x) " Y" (RTS $y)
     " Z" (RTS $z) " VECTOR:" (TOSTR $vector)))
)
```

DRILLING

This event activate the drilling cycle. The drilling tool is already in position for drilling.

$attrib	String	The variable shows the value entered in the HOLE drilling function. If no attribute are entered or if the drilling are used as piercing then the value is an empty string.
$depth	Real	The incremental depth from the start point x,y,z
$drillbytype	int	By this variable you can read what kind of optimizing the drilling sequences is set to: 0=Sheetwice, 1=Toolwice, 2=Partwice, 3=No optimation. When using number 3 (No optimizing), then the PIERCING will set the variable $ptype to 4.
$drillfeed	Real	Drilling feed in mm/min (this variable is available also in the header).
$drillmax	Int	Number of drillings made together in this sequence.
$drillnum	Int	First drilling will have number 1 the second number 2 and so on.
$drillrpm	Int	Revolutions per minute (this variable is available also in the header).
$drillstep	Real	Drilling step (this variable is available also in the header).
$f	Real	Drilling feed in mm/min
$x	Real	The X-coordinate for the drilling position.
$xraw	Real	The X-coordinate for height sensoring position.
$y	real	The Y-coordinate for the drilling position.
$z	Real	The z-value for the tool refer to table, thickness or highest position. This can be set in the machine setting.
$yraw		The Y-coordinate for height sensoring position.
$holediameter	Real	If the drilling is made with the HOLE command and the source is a circle then ths variable is the diameter of the circle. When the drilling is done for piercing or if the source is not a circle then the value is 0.

FOOTER

This function are the last function that will be called while the CNC-file is open. Following variable can be used.

$cutlen	Real	Total cutting length for one jet
$runsec	Int	Theoretical estimated time for the machine to do the job.
$runtime	String	The values above converted to a string
$igems	String	This is a string with the version of IGEMS.
$post	String	This is a string with the name of the postprocessor

$pumpstop	Bool	T if the pump should be stopped automatically else nil
$x	Real	The X-coordinate for the parking position. This coordinate are not transformed. It's exactly the value that are set in the strategy.
$Y	Real	The Y-coordinate for the parking position. This coordinate are not transformed. It's exactly the value that are set in the strategy.

The function MRAPID can be called from the footer function.

Example:

```
(DEFUN footer()
 (MRAPID)
 (WRITE (STRCAT (NTXT) "(SECONDS " (ITOA $runsec) ")"))
 (WRITE (STRCAT (NTXT) "(USED TIME " $runtime ")"))
 (WRITE (STRCAT (NTXT) "(IGEMS:" $igems " POST:" $post " Date:" datum ")")))
 (WRITE (STRCAT (NTXT) "M30"))
 (WRITE "%")
)
```

FINAL

This function is called after that all postprocessing has been executed and the CNC-file is closed.

FMODE

This function handles different feed rate modes.

The function has following variables:

$flin	Int	The variable can have following settings: 0=Flin main switch. Flin should be deactivated 1=Flin main switch. Flin should be activated, next movements has different start and end speed. 2=Next movement have another start speed than last movements end speed.
$fe	Real	The cutting speed at the end of next object.
$fs	Real	The cutting speed at the beginning of next object.

Note!

The variable $flin can be used in other function. It's nil if FLIN in not activated. In all other cases it is 0, 1 or 2.

HEADER

If you want to take care of this event then you must include a function in the postprocessor with the name HEADER. The header event is always called at the beginning of the postprocessing. The function can be used to view information, initialize values, and set default values for G and M-codes. The function can use following variables.

$6x-direction	Int	An integer that means following directions of the rotation unit. 0=1,0,0 (East) 1=0,1,0 (North) 2=-1,0,0 (West) 3=0,-1,0 (South)
$6x-origo	List	This is the distance to the part zero in 3D-5X on 6x-toolpaths

$6x-reverce	Bool	T if the value of $C is reversed else nil.
$abrasive	String	This variable has the name of the Abrasive Quality. If it’s not a waterjet machine then this variable will be empty "".
$abrasiveflow	Int	Amount of abrasive in gram (note in the strategy setting)
$abs	Bool	T if the coordinate are in Absolute mode (G90) and nil if the coordinate are in incremental mode (G91)
$alloy	String	This is the Material Quality.
$box	List	This is a list of 4 reals that describe a rectangle area that can include all parts. (X-lower left, Y-lower left, X-upper right, Y-upper right)
$build	Int	Build version number. This variable was introduced in version 2016.3.1060. For example: Version 2016.3.1060 will return 1060.
$cando5x	Bool	T if the machine has possibilities to cut 5X cutting else nil. See also the variable $uses5x.
$cando6x	Bool	T if the machine has possibilities to make 6X cutting else nil. See also the variable $uses6x.
$cpfeed	Real	Velocity for circular piercing in mm/min.
$cpradius	Real	Radius for circular piercing. The value describe the movement of the tool.
$cptime	Real	Time in seconds for circular piercing.
$cpturns	Real	Number of turns for circular piercing.
$contains	Int	A bit coded value that can be used to check in advance what different kinds of operations are included in the job. This variable will contain many kind of operations later but just now only hole command with cutting option. Summary of following 0= 1=Cutting (Not released) 2=Marking 4=Low pressure piercing 8=Drilling 16= 32=Hole command cutting option 64= 128= 254= Up to 15 bits value will be available.
$cutbar	Int	Pressure for cutting in AWJ cutting and Pure waterjet cutting.
$cutparname	String	This is the name of the actual cutting parameter setting.
$cutflow	Int	Amount of abrasive for cutting in gram/min.
$cuttingupz	real	The value for the lift height between cuttings (checking what's possible).
$date	String	The date in the format at used in current country.
$digfile	String	The name if the actual drawing. If the file is saved then drive and path are included in the name.

$drillbytype	Int	0=Sheetwice drilling. 1=Toolwice drilling. 2=Partwice drilling. 3=No optimizing, the drilling will be make at the Cuton function.
$drillfeed	Real	Feed for drilling.
$drillrpm	Int	Rpm for drilling tool.
$drillstep	Real	Drilling step.
$drillupz	real	The value for the lift height between drilling positions (checking what's possible).
$f	Real	Fixed speed for AWJ and pure waterjet
$fine	Real	Cutting speed for fine quality (see also $xrough, $rough, $medium and $xfine).
$fnumber	Int	When using numbers as name of the NC-file then this variable contains that number. If you use the drawing name as default filename or typing a filename that cant be converted to number then this value will be 1000.
$group	String	This is the material group.
$highbar	Int	The highest bar of $markbar, $piercbar and $cutbar in AWJ-cutting (for machines that only support two different pressures) (*)
$highflow	Int	The highest amount of abrasive used on the job. (For machines that only support two different levels of abrasive).
$kerfsize	Real	This is the tool radius if the kerf should be handled completely in the controller.
$kinematic	Int	This variable shows how the tiltangles are calculated on 5-axis machines. 0=No 5-axis cutting head is configured. 1=Control by motor axis 2=Major axis in direction of cutting, second axis is the cutting angle. 3=Major axis in direction of jet, second axis is the cutting angle.
$lowatend	Bool	This variable is T if the first cut should start with Low pressure. It's normally used to set the pressure to low at the end of the program. Good when running the same program over and over again.
$lowbar	Int	The lowest bar of $markbar, $piercbar and $cutbar in AWJ-cutting (for machine that only support two different pressures) (*)
$lowflow	Int	The lowest amount of abrasive used on this job. (For machines that only support two different levels of abrasive).
$machine	String	This is the name of the Machine Setup
$machinetype	Int	0=AWJ, 1=Pure water, 2=Plasma, 3=Oxyfuel, 5=Laser.
$markbar	Int	Pressure for markings in AWJ-cutting(*)
$markbytype	Int	0=Sheetwise marking. 1=Toolwise marking. 2=Partwise marking. 3=No optimizing, the marking will be done in the order of the programmed toolpath.
$markflow	Int	Amount of abrasive for marking in gram/min.
$markupz	real	The value for the lift height between markings (checking what's possible).
$maxbar	Int	Maximum possible pressure.

$maxslope	Real	Maximum cutting angle that will be used on entire job. Note! This variable has another meaning in the Piercing function. The value is not negative and in degree.
$maxspeed	Real	Maximum speed used in the program
$maxtilt	Real	Maximum tilting angle for the 5-axis cutting head. If No 5-axis head is configured then this value is 0. The value is in degree.
$maxtools	Int	Number of cutting tools
$medium	Real	Cutting speed for straight cut in medium quality (see also $xrough, $rough, $fine and $xfine).
$metric	Bool	T on Metrical units and nil if Imperial mode (inches)
$minbar	Int	Minimum possible pressure.
$minspeed	Real	Minimum speed used by the program
$name	String	The name of the CNC-file.
$nlines	Bool	The variable I T if line number should be used else nil.
$orifice	Real	Diameter of the Orifice
$partupz	real	The value for the lift heigt between parts (checking what's possible).
$piercbar	Int	Pressure for piercings in AWJ cutting(*)
$piercebytype	Int	0=Sheetwise pre-piercing. 1=Toolwise pre-piercing. 2=Partwise pre-piercing. 3=No optimizing, the pre-piercing will be done together with the cutting of the geometry by the Cuton function.
$piercflow	Int	Amount of abrasive for piercing in gram/min.
$piercupz	real	The value for the lift height between piercings (checking what's possible).
$pstat	Real	Piercing time for stationary piercing in seconds
$pumpstart	Bool	T if the pump should be started automatically else nil
$pumpstop	Bool	T if the pump should be stopped automatically else nil
$rough	Real	Cutting speed for straight cut in rough quality (see also $xrough, $medium, $fine and $xfine).
$sensordist	Real	The distance between each measurement. If no stamping sensor is activated then this value is 0.
$sensorminlift	Real	The minimum lift height from material when using hight sensor.
$sensormode	Int	If the value is: -1= No Sensor should be used at all. 0 = Sheetwise measure. The sensor is measure the height once in the beginning of the CNC-file. 1 = Partwice measure. The height sensor is measure the height once at every part. 2= Dragging sensor. The measurement is done all time. 3= Stamping sensor. The measurements are by a curtain distance.
$sensorsec	Real	The time in second between each measurement. The time is based on straight cut in medium quality. If no stamping sensor is activated then this value is set to 0.

$sheetx	Real	Size of the sheet in X direction (CAD coordinates). If no sheets are in use then the value is 0.
$sheety	Real	Size of the sheet in Y direction (CAD coordinates). If no sheets are in use then the value is 0.
$speedmarking	Real	Speed that will be used for marking
$speedrapid	Real	Speed that will be used for Rapid movements in X and Y
$standoff	Real	**Major changes in R2015.3** The value is automatically added to all Z-values in the postprocessor. The $standoff variable value is therefore automatically changed to value 0.0 (to avoid double modifications) There is a variable called *StandoffInitial*. If this value is set to T in the beginning of the postprocessor than no extra standoff is added to the Z-values. In this case you should modify the Z-zero of the cutting plan in beginning of the file. In this case the $standoff has the value of the standoff from the strategy setting.
$thickness	Real	The thickness of the material.
$time	String	The actual time
$toolchanges	Int	Number of tool setups. Minimum is 1.
$tube	Real	Diameter of mixing tube
$type	Int	Machine type: 0=AWJ, 1=Pure water, 2=Plasma, 3= Oxyfulel, 4=Laser
$uses5x	Bool	T if 5X cutting will be used in the actual process. From version R2016.3.1036 this variable is T also when TAC is used.
$uses6x	Bool	T if 6X cutting will be used in the actual process else nil.
$usesdrill	Bool	T if a drill will be used in the actual process.
$xfine	Real	Cutting speed for straight cut in X-fine quality (see also $xrough, $rough, $medium and $fine).
$xrough	Real	Cutting speed for straight cut in X-rough quality (see also, $rough, $medium, $fine and $xfine).
$z	Real	This value is initialized to the lift height that is used between parts.
$zbase	Int	0=The Z-zero should be at the table of the machine. 1=Zero should be at the material thickness or the surface of the material. 2=Zero should be at the very top position. If you want to control the default in the postprocessor then set the variable *ZBase* to wanted value in the beginning of the postprocessor.
$zmaxmove	Real	The maximum accepted Z-movement from machine table to upper position.
$zmaxup	Real	The larges Z-axis value that can be used. This is different depending on the $Zbase value. Example: $zbase=1 and $zmaxmove is 300. If you have a 12 mm material and an underlay of 5 then $zmaxup will be 200-thickness – underlay =283.
$zmaxzaxis	int	Number of movable Z-axis

$zmode	Int	The $zmode have following meaning. 0=Fixed Z-axis. 1=Automatic, Up/Down controlled by water On/Off. 2=Up/Down with separate M-codes. 3=Up/Down controlled by Z-coordinates. 4=Automatic Height sensor that are controlled by water On/Off. 5=Height sensor that are controlled by M-codes. 6=Height sensor that are controlled by Z-coordinates. 7=By measuring probe information.
$zmovedown	real	This value can be used to move down the zero point from the Machine coordinate system if it's located on the highest position to the surface of the material. This value is useful when the $zbase is 1 but the value will be correct for $zbase 0 and 2 as well.
$zmovedown	real	This value can be used to move up the zero point from the Machine coordinate system if it's located on the table to the surface of the material. This value is useful when the $zbase is 1 but the value will be correct for $zbase 0 and 2 as well.

(*) In pure waterjet cutting this variable is set to the same value as $cutbar

Example 1:

```
(DEFUN header()
  (WRITE "%")
  (WRITE (STRCAT (NTXT) "G40"))
)
```

Example 2:

```
(DEFUN header()
  (WRITE (STRCAT (NTXT) "(FILE: " $name ")"))
  (WRITE (STRCAT (NTXT) "(MATR: " $Group "/" $alloy "/" (RTS $thickness) ")"))
  (WRITE (STRCAT (NTXT) "(DRAWING: " $digfile ")"))
  (WRITE (STRCAT (NTXT) "(DATE: " $date ")"))
  (WRITE (STRCAT (NTXT) "(MACHINE: " $machine ")"))
  (WRITE (STRCAT (NTXT) (IF $metric "G71" "G70")))
  (WRITE (STRCAT (NTXT) (IF $abs "G90" "G91")))
  (WRITE (STRCAT (NTXT) "G40 G00"))
)
```

This could generate a CNC-file like follows:

```
(FILE: P277)
(MATR: INOX/Standard/20)
(DRAWING: C:/R10-IDE/SAMPLE.dig)
(DATE: 2011-01-18)
(MACHINE: IGEMS)
G71
G90
G40 G00
```

ITEXT

This function is called if you are using inkjet equipment.

$angle	Real	The angle in radians of the text.
$length	Real	The length of the text.

$height	Real	The height of the text.
$font	String	The font used.
$txt	String	The text that should be printed.
$x	Real	The center of the text in X
$y	Real	The center of the text in Y
$z	Real	The center of the text in Z
$fe	Real	The cutting speed at the end of the movement.

```
(DEFUN itext ()
 (WRITE (STRCAT (NTXT) "G00 X" (RTS $x) " Y" (RTS $y) " Z" (RTS $z)))
 (WRITE (STRCAT (NTXT) "A:" (ATS $angle) " (ANGLE OF TEXT)"))
 (WRITE (STRCAT (NTXT) "L:" (RTS $length) " (LENGTH OF TEXT)"))
 (WRITE (STRCAT (NTXT) "H:" (RTS $height) " (HEIGHT OF TEXT)"))
 (WRITE (STRCAT (NTXT) "F:" $font " (TEXT FONT)"))
 (WRITE (STRCAT (NTXT) "T:" $txt " (TEXT TO PRINT)"))
 (WRITE (STRCAT (NTXT) "M100 (PRINT)"))
 (WRITE "")
)
```

LINE

This is the basic movement event. All other movements can be with lines.

The function can use following variables:

$a	Real	The angle in radians of the major axis. If no 5-axis equipment are in use this variable is always 0.
$amotor	Real	The angle in radians of the major axis. The value is always in motor degree.
$ab	Bool	T if the movement have any A or B information else the variable is nil.
$b	Real	The angle in radians of the minor axis. If no 5 axis equipment are in use this variable is always 0
$bmotor	Real	The angle in radians of the minor axis. The value is always in motor degree.
$c	Real	The angle in radians of the 6th axis. If no rotation unit are in use this variable is always 0.0
$delta	Real	This value describes the tangential angle between current LINE and next movement. The value is 0 if next movement is in same direction. It's negative is next movement start in minus relative direction. It's positive if next object start in positive relative direction. The value is always between –PI to +PI
$f	Real	Current speed for this line in mm/min (this value can normally be used).
$fe	Real	The cutting speed at the end of the movement.

$flag	Int	This is a bit value with following meaning: 1=Belongs to a lead-in 2=Belongs to a lead out 4=Belongs to marking 8=Belongs to circular piercing 16 32 64=Belongs to a custom line.
$fs	Real	The cutting speed at the start of the movement.
$kerf	Int	Actual kerf: 0=No kerf (G40), 1=Tool on right side (G41), 2=Tool on left side (G42)
$last	Bool	This variable I T if it's the last movement before jet turns of
$len	Real	The length of the arc.
$slope	Real	The max cutting angle at this position. Vertical is 0.0 The angle is caclulated in the vector direction as radians.
$vector	list	A list of three values that describe the direction of the jet. Example: (0 0 -1)
$x	Real	The X-coordinate of the endpoint of the movement.
$y	Real	The Y-coordinate of the endpoint of the movement.
$z	Real	The z-value for the tool refer to table, thickness or highest position. This can be set in the machine setting.
$zref	Int	This variable is nil if no pre-measuring tool are used. In other case it's an integer that refers to that measure point that is measured by the MEASURE function.

Example:

```
(DEFUN line (/ extra)
 (IF $zref (SETQ extra(STRCAT " Z#" (ITOA $zref))) (SETQ extra ""))
 (IF $chkerf
  (WRITE (STRCAT (NTXT) "G1 G4" (ITOA $kerf) " X" (RTS $x) " Y" (RTS $y) extra " F" (RTF $f)))
  (WRITE (STRCAT (NTXT) "G1 X" (RTS $x) " Y" (RTS $y) extra " F" (RTF $f)))
 )
)
```

If you are using a cutting speed interpolation, then you can use the variables $fs and $fe . By comparing these values you can calculate if the cutting speed on the line is in retardation or in acceleration mode or if the cutting speed is the same for the whole object.
The values ($X, $Y) are transformed according to the Axis direction settings in the Machine setup.

MARKON

This function is used for activate marking if the machine is equipped with a special marking tool. If the cutting tools are used for marking then the normal PIERCING function are used.

$starttan	Real	Angle of the first cutting direction on the geometry. Note this value is in radians. This variable is also available in the RAPID function.

Add information about $useawj $wacode

MEASURE

This function is called if the option "Height measuring" is activated.
The idea is that the machine will measure the height on the given positions and that the height is stored in the controller memory for later use during the cutting. The method is often used on 5-axis cutting machines that can't use a height sensor during the cutting.
The function can use following variables.

$x	Real	The X-coordinate of the endpoint of the movement.
$y	Real	The Y-coordinate of the endpoint of the movement.
$zref	Int	This variable is index that counts up by one for each point. The index starts with 0 or 1 for each new measuring sequence.

Example:

```
(DEFUN measure ()
 (WRITE (STRCAT (NTXT) "G00 X" (RTS $x) " Y" (RTS $y)))
 (WRITE (STRCAT (NTXT) "MEASURE(" (ITOA $zref) ")"))
 (SIM-DELAY 2.5) ; Add 2.5 second to the simulation, reports and cost calculation
)
```

The function could generate following CNC-file.

```
N12 G00 X200.513 Y201.678
N13 MEASURE(1)
N14 G00 X200.000 Y101.780
N15 MEASURE(2)
N16 G00 X200.000 Y2.000
N17 MEASURE(3)
N18 G00 X102.000 Y0.000
N19 MEASURE(4)
```

MRAPID

This event should move the tools to the X,Y position using the machine coordinate system.

$x	Real	The X-coordinate of the endpoint of the movement. This value is not transformed
$y	Real	The Y-coordinate of the endpoint of the movement. This value is not transformed
$reason	Int	This value have following meaning: 1=If the MRAPID is called because it's go to service position before 5x-cutting 2=If the MRAPID is called on making a Parking position

PART

This event gives information about the part that now will be in use.
Following variables can be used:

$partname	String	The name of the part as defined in Create part
$customer	String	The name of the customer as defined in Create part
$partdate	String	The date as defined in Create part
$quantity	Int	Number if parts defined in Create part.
$connected	Bool	If the tool path is connected with the part
$partid	Int	The ID the part

$box	list	A list of four reals that describe LoweLeft corner and Upper Right corner (X Y X Y)
$boxcenter	list	Center of the bounding $box
$boxrotated	list	A list of four reals that describe LoweLeft corner and Upper Right corner (X Y X Y) in actual rotation angle of the part.
$orderattrib	String	The attribute added on the part in the Order command.

$partname, $customer and $partdate. All data is from the information added when the part was created.

Example:

```
(DEFUN part()
  (WRITE (STRCAT (NTXT) "($name " " $customer " " $date ")"))
)
```

PIERCING

This event is used to turn ON the cutting or the marking process (see also MARKON).

To be able to use this event a function named PIERCING must be implemented in the post.

Following variables are available:

$attrib	String	This is the attribute given in the hole command or the attribute given in the marking command. New in R2017.3.388
$ab	Bool	T if the movement have any A or B information else the variable is nil.
$bar	Int	Actual pressure that will be used at the start of the piercing.
$circ	Bool	If circular piercing should be used or not.
$cpfeed	Real	The velocity used in circular piercing.
$cpradius	Real	This is the movement radius that should be used for circular piercing.
$cpturns	Real	Number of turns that should be used for circular piercing
$ctype	Int	1: Tilted piercing 2: Tilted cutting (bevel mode is top, bottom or advanced) 4: Top bevel 8: Bottom bevel 16: Ruled bevel.
$delay	Real	Delay between water and abrasive on.
$external	Bool	T if the piercing belong to an external geometry else nil (NOTE! See $edge below)
$edge	Int	-1 Means it's an external contour 0 Means an open contour (slot or common cutline or marking) 1 Means it's an inside contour
$gram	Int	Actual amount of abrasive that should be used at the start of the piercing.
$high	Bool	If the piercing is made with the same pressure as cutting then variable is T else nil.
$kerf	Int	The variable give information about the kerf that will be used after the piercing is finish. 0=No kerf, 1=Left (G41), 2=Right (G42). Tis instruction shoul nomraly be written to the CNC-file. When using all kind of bevel cutting and when using IGEMS internal toll radius compensation this value is always 0. Note! See also $side that have a similar meaning.

$lowatoff	Bool	If this cut should end in low pressure, to have the value correct for next piercing.
$lowhigh	Bool	If it's a low pressure piercing without optimizing. **Note!** The variable $high is also T in this case, be sure to test $lowhigh first in a COND function.
$maxslope	Real	Maximum cutting angle that will be used on actual geometry. Note! This variable has another meaning in the Header function. The value is not negative and in degree.
$marking	Bool	The variable is T if the cutoff belongs to a marking else this variable is nil
$pstat	Real	Piercing time on for stationary piercing (you can normally use $time that have the time for the actual piercing type).
$ptype	Int	The piercing type: -2=Point marking -1=Marking 0=Blind lead 1=Linear piercing 2=Stationary piercing 3=Circular piercing 4=Drilling with no optimizing (Se also the drilling function) 5=Air start 6=User (The piercing type 4 means drilling and it do not use the Piercing function, it use the drilling function.)
$side	Int	The variable give information about the tool side used when making the toolpath. This value is 0, 1 or 2 also when IGEMS Internal tool radius compensation are used. This variable is similar as $kerf, but for special cases when it's important to know the kerf side. 1 or 2 does not means that G41 or G42 should be used in the CNC-file.
$speedramp	Bool	Flag for the speed optimization command.
$starttan	Real	Angle of the first cutting direction on the geometry. Note this value is in radians. This variable is also available in the RAPID function.
$tacflag	Bool	This 2D geometry should be cut with TAC
$time	Real	The time for the piercing or the delay time after the jet has been turned on (this can normally be used).
$useabr	Bool	Is T if abrasive should be used else nil
$usebevel	Bool	This value is T if the actual cut has Bevel cuts.
$usebeveltac	Bool	This value is T if TAC is activated on Bevel cuts
$usetac	Bool	This value is T if TAC will be used on the actual 2D-geometry. **Note!** This flag is nil on all Bevel cuts.
$vaccumAssist	Bool	This value is T is vacuum assist should be used on low pressure piercings. The function is only activated on Sheet wise, Tool wise and Part wise pre-piercing.
$vacuumOndelay	Real	Delay time between vacuum on and abrasive on
$wacode	Bool	Is T if different codes should be used for Abrasive and water on. Is nil if only one code should be used.

Example 1:
This example will create a circular piercing by adding normal G1, G3 codes. This will be done by the internal function (CIRC-PIERCING).

```
(DEFUN piercing()
 (WRITE (STRCAT (NTXT) "(PIERCING TYPE " (ITOA $ptype) ")"))
 (COND
  ((AND $useabr $wacode); If abrasive should be used and the machine use different codes for water and abrasive
   (WRITE (STRCAT (NTXT) "M4 (WATER ON)"))
   (DELAY $delay)
   (WRITE (STRCAT (NTXT) "M6 (ABRASIVE ON)")))
  ($useabr ; If abrasive should be used
   (WRITE (STRCAT (NTXT) "M10 (WATER AND ABRASIVE ON)")))
  (T     ; If no abrasive should be used
   (WRITE (STRCAT (NTXT) "M4 (WATER ON)")))
 )
 (IF $circ
  (CIRC-PIERCING) ; Use circular piercing. IGEMS will add all needed movements automatically.
  (DELAY $time)   ; If not using circular piercing, then add a delay time
 )
)
```

The example above will generate a CNC-file as below.

```
N19 (PIERCING TYPE 3)
N20 M4 (WATER ON)
N21 G04 F1.1
N22 M6 (ABRASIVE ON)
N23 G01 X130.016 Y164.665 F273
N24 G03 X128.616 Y164.665 I-0.7 J0 F273
N25 G03 X130.016 Y164.665 I0.7 J0 F273
N26 G03 X128.616 Y164.665 I-0.7 J0 F273
N27 G03 X130.016 Y164.665 I0.7 J0 F273
N28 G03 X128.616 Y164.665 I-0.7 J0 F273
N29 G03 X130.016 Y164.665 I0.7 J0 F273
N30 G03 X128.616 Y164.665 I-0.7 J0 F273
N31 G03 X130.016 Y164.665 I0.7 J0 F273
N32 G03 X128.616 Y164.665 I-0.7 J0 F273
N33 G03 X130.016 Y164.665 I0.7 J0 F273
N34 G03 X128.616 Y164.665 I-0.7 J0 F273
N35 G03 X130.016 Y164.665 I0.7 J0 F273
N36 G03 X128.616 Y164.665 I-0.7 J0 F273
N37 G03 X130.016 Y164.665 I0.7 J0 F273
N38 G03 X128.616 Y164.665 I-0.7 J0 F273
N39 G03 X130.016 Y164.665 I0.7 J0 F273
N40 G03 X129.202 Y165.356 I-0.7 J0 F273
N41 G01 X129.316 Y164.665 F273
N42 G01 G41 X130.968 Y168.308 F34.8
```

Example 2:
If you prefer a more compact CNC-code, then you can replace the (CIRCULAR-PIERCING) function as following example that is made for a Fanuc controller.

```
 (IF $circ
  (PROGN
   ($CLINE $cpradius 0 $cpfeed); Generate a line (G1) with this length
   (WRITE (STRCAT (NTXT) "#100=" (ITOA $cpturns))); Set the variable #100 to the number of turns
   (SETQ nline $nnext); Save next N number in a variable
   ($CCIRCLE (- $cpradius) 0 $cpfeed); Generate a circle
   (WRITE (STRCAT (NTXT) "#100=[#100-1]")); Decrease the variable #100 by 1
   (WRITE (STRCAT (NTXT) "IF[#100 GT 0] GOTO " (ITOA nline))); If #100 > 0 then jump back to $CCIRLE line
   ($CLINE (- $cpradius) 0 $cpfeed)); Generate a line back to start point
  (DELAY $time))
```

```
N19 (PIERCING TYPE 3)
N20 M4 (WATER ON)
N21 G04 F1.1
N22 M6 (ABRASIVE ON)
N23 G01 X130.016 Y164.665 F273
N24 #100=8
```

```
N25 G03 X128.616 Y164.665 I-0.7 J0 F273
N26 G03 X130.016 Y164.665 I0.7 J0 F273
N27 #100=[#100-1]
N28 IF[#100 GT 0] GOTO 25
N29 G01 X129.316 Y164.665 F273
N30 G01 G41 X130.968 Y168.308 F34.8
```

The functions $CLINE and $CCIRCLE use the LINE and ARC functions to add the G01 and G03 movements.

System variables for Piercing

By using following system variables you can override the information in the material setting.

AWJStationaryPiercing	Real	Piercing time for stationary piercing.
AWJCircularPiercingSpeed	Real	Velocity for circular piercing in mm/min
PiercingDiameter	Real	The diameter of the movement for circular piercing. Note! By increasing the value you the piercing may damage some parts on the drawing.
AWJDelayAfterPiercing	Real	The shortest possible piercing time.
CustomCircularPiercing	Bool	Set this variable to T if you don't use the inbuilt function (CIRC-PIERCING) in other case you will not have a correct simulation or time/cost calculation.

Different machine types use different piercing types

Piercing and leads

Following piercing methods should be supported.

Value	Name in the CAM system	AWJ	Water	Plasma	Oxyfuel	Laser
0	Contour start	Y	Y			
1	Linear ramping (Direct start)	**Y**				Y
2	Stationary	Y	**Y**	**	**	**
3	Circular (Name is normal for all types except AWJ)	Y		**Y***	**Y***	**Y***
4	Drilled	Y		Y		
5	Air start	Y		Y	Y	Y
6	User	Y	Y	Y	Y	Y

When switching between machine types, and the piercing type is not supported then it will use the bold type.

* In the CAM system the internal handling is like Circular/Normal. The area around the piercing is checked to not be to close the part or neighbors. The Circle/Normal method can be used in the CAM-system.

** While postprocessing the method number 3 is changed to method number 2. The method used in the machine is Stationary but circular in the software.

QUALITY

This function is always activated before the PIERCING function. It can also be used during the cutting. In most controllers we don't need this event.

The QUALITY function can use following variables:

$initqua	Bool	If the quality command is called before the piercing (start quality). If this variable is T then $chqua is nil and opposite.

$chqua	Bool	If the quality change is inside a geometry while the cutting process is active then the variable is T else its nil. If this variable is T then $initua is nil and opposite.
$qua	Int	The quality of the cut. 1=X-Rough, 2=Rough, 3=Medium, 4=Fine and 5 is X-Fine
$f	Real	Cutting speed for straight cut in selected quality

Example:

```
(DEFUN quality ()
 (IF $chqua
  (WRITE (STRCAT (NTXT) " (QUALITY CHANGED TO " (ITOA $qua) " DURING CUTTING)"))
  (WRITE (STRCAT (NTXT) " (QUALITY INITIALIZED TO " (ITOA $qua) " BEFORE CUTTING START"))
 )
)
```

RAPID

The rapid function is always activated to move the jet between different positions in non cutting mode.

$c	Real	The angle in radians of the 6th axis. If no rotation unit are in use this variable is always 0.0
$fr	Real	The velocity for the movement in mm/min
$reason	Int	0=Normal rapid 1=Manual rapid inserted in a part (only between cuttings in 2D) 2=Manual rapid inserted in the order command between the parts (only between cuttings) 3=Rapid to a drilling point 4=Rapid inside a 3D-5X part (from R2016.3.1080) Note! It is important that the movement are interpolated. If G00 does not interpolate then use G01 with a high speed. 5=Rapid inside a 3D-5X part, this is the last movement of the rapid, before piercing. 6=Rapid to the Stop point generated in 3D-5X
$starttan	Real	Angle of the first cutting direction on the geometry. Note this value is in radians. This variable is also available in the PIERCING and MARKON functions.
$x	Real	The X-coordinate.
$y	Real	The Y-coordinate.
$z	Real	The z-value for the tool refer to table, thickness or highest position. This can be set in the machine setting.

Example:

```
(DEFUN rapid ()
 (WRITE (STRCAT (NTXT) "G00 X" (RTS $x) " Y" (RTS $y)))
)
```

REFPOS

This function will be called if the Ref pos option is used in the toolpath command in 3D-5X. The function will be called just before the RAPID to the piercing point before cuton. This is similar to the DATAPOINT command.

$a	Real	The major axis rotation in radians

$b	Real	The secondary axis rotation in radians
$x	Real	The position in X
$y	Real	The position in Y
$z	Real	The position in Z
$vector	List	The direction of the vector

```
(DEFUN refpos ()
 (WRITE (STRCAT (NTXT) "(REFPOS X" (RTS $x) " Y" (RTS $y) " Z" (RTS $z)
     " C"(ATS $a) " A" (ATS $b) " VECTOR:" (TOSTR $vector) ")"))
)
```

REWIND

IGEMS will automatically call the rewind function if the variable *InternalRewind* is T.
In the beginning of the postprocessor write following:

```
(SETQ *InternalRewind* T)
```

If you want to handle the rewind functionality by your own code, set the variable to nil or do not include this line at all.

$a	Real	The major axis rotation in radians
$b	Real	The secondary axis rotation in radians

```
(SETQ *InternalRewind* T)
(DEFUN rewind ()
 (WRITE (STRCAT (NTXT) "M5 (JET OFF)"))
 (WRITE (STRCAT (NTXT) "G00 A" (ATS $a) "B" (ATS $b)))
 (WRITE (STRCAT (NTXT) "M3 (JET ON)"))
)
```

ROTAX

The rotax function was released in IGEMS R2014.4.533
This function is called when a movement of the 5X kinematic is needed and there is no movement in X or Y. If there is no ROTAX function declared in the postprocessor then the LINE command will be called.
Following variables are available.

$arel	Real	The relative changing of the primary axis in radians.
$brel	Real	The relative changing of the secondary axis in radians.
$ft	Real	The time it should take for the movement in minutes.
$a	Real	The major axis rotation in radians
$b	Real	The secondary axis rotation in radians

Some controller switch automatically to degree/minutes if no X or Y movement will be used.
Following example can be used if the summary of the rotations of primary and secondary axis should be calculated:

```
(DEFUN rotax (/ rot)
 (SETQ rot (+ (ABS (* (/ 180 PI) $arel)) (ABS (* (/ 180 PI) $brel))))
 (SETQ feedstr (STRCAT " F" (RTF (/ rot $ft))))
 (WRITE (STRCAT (NTXT) "G1 C"(ATS $a) " A" (ATS $b) feedstr))
)
```

Use this example if the speed should be calculated in that rotation axis that have the most rotation:

```
(DEFUN rotax (/ rot)
 (SETQ rot (MAX (ABS (* (/ 180 PI) $arel)) (ABS (* (/ 180 PI) $brel))))
 (SETQ feedstr (STRCAT " F" (RTF (/ rot $ft))))
 (WRITE (STRCAT (NTXT) "G1 C"(ATS $a) " A" (ATS $b) feedstr))
)
```

Use this example if you want to use speed defined by Invers time (normally G93)

```
(DEFUN rotax ()
 (SETQ feedstr (STRCAT " F" (RTOS (/ 1 $ft) 2)))
 (WRITE (STRCAT (NTXT) " G93"))
 (WRITE (STRCAT (NTXT) "G1 C"(ATS $a) " A" (ATS $b) feedstr))
 (WRITE (STRCAT (NTXT) " G94")) ;change back to mm/min
)
```

On some machines the G93 use time (not Invers time)

```
(DEFUN rotax ()
 (SETQ feedstr (STRCAT " F" (RTOS $ft 3)))
 (WRITE (STRCAT (NTXT) " G93"))
 (WRITE (STRCAT (NTXT) "G1 C"(ATS $a) " A" (ATS $b) feedstr))
 (WRITE (STRCAT (NTXT) " G94")) ;change back to mm/min
)
```

SRAPID

The SRAPID function handles the Start rapid points that can be entered from the part order command. The function is called in the beginning of postprocessing.

The SRAPID function can use following variables.

$attrib	String	This is a text string with the text attribute (used to handle different equipment)
$x	Real	The X-coordinate of the endpoint of the movement.
$y	Real	The Y-coordinate of the endpoint of the movement.

The SRAPID will never be called to handle normal rapid events.

STOP

The stop event is used to generate a stop in the cutting process.

Following variables are available.

$msg	String	A text message that is added in the Edit toolpath or Order command or an automatic generated text that comes from the stop options in the Method window.
$cond	Bool	The variable is T if the checkbox Conditional is activated in the Stop dialog else nil.
$reason	Int	The reason value has following meaning: 1=A stop generated in the Edit part command. 2=A stop generated in the Order command. 3=If the option "Stop after first cut" is activated. 4=If the option "Stop after first part" is activated. 5=If the option "Always pre-piercing is activated". This is mainly developed for 5-axis cutting, the STOP event will be used just before the cutting start. 6=If no cleaning or pressure release point is specified. 7=Stop generated by the Stop command in 3D-5X

Example 1:
This example will add M00 and a automatic generated message

```
(DEFUN stop ()
 (WRITE (STRCAT (NTXT) "M00 (" $msg ")"))
)
```

Example 2:
This example shows how the STOP event can be customized. Depending on the $reason you can add different information to the CNC-file.

```
(DEFUN stop ()
 (COND
  ((= $REASON 1)
   (WRITE (STRCAT (NTXT) "M00 (STOP IN EDIT PART MESSAGE: " $msg ")")))
  ((= $REASON 2)
   (WRITE (STRCAT (NTXT) "M00 (STOP IN ORDER MESSAGE: " $msg ")")))
  ((= $REASON 3)
   (WRITE (STRCAT (NTXT) "M00 (STOP AFTER FIRST CUT)")))
  ((= $reason 4)
   (WRITE (STRCAT (NTXT) "M00 (STOP AFTER FIRST PART)")))
  ((= $reason 5)
   (WRITE (STRCAT (NTXT) "M00 (STOP BEFORE 5X-CUTTING)")))
 )
)
```

TEXT

Normally all text are generated with the configured marking device and then MARKON, LINES, ARCS MARKOFF events are used in to generate the text. This event can be used if you want to use other equipment than the normal marking device.
The event has following variables:

$angle	Real	The angle of the text
$attrib	String	The attrib at is was given in the Marking command.
$height	Real	The text height
$length	Real	The length of the text
$font	String	The name of the text font
$txt	String	The text in Unicode NOTE! This variable is changed from $TEXT
$fonttype	Int	The type of font. 0=trueType
$x	Real	The X-coordinate of the center of a box containing the text.
$y	Real	The Y-coordinate of the center of a box containing the text

Example:

```
(DEFUN text ()
 (WRITE (STRCAT (NTXT) "G0 X" (RTS x)

)
```

TILT

This function is called if you have 5-axis equipment ant you need to make a movement in the A and B or one of the axis without any movement in X or Y.

$a	Real	The angle in radians of the major axis. If no 5-axis equipment are in use this variable is always 0.
$b	Real	The angle in radians of the minor axis. If no 5 axis equipment are in use this variable is always 0
$reason	Int	The $reason means following: 2=Rotate the axis for tilted piercing. 3=Rotate the A axis to correct angle before piercing 4: Called from the fotter
$starttan	Real	Angle of the first cutting direction on the geometry. Note this value is in radians.

In versions later than 2014.4.538 you can control the order between the TOOLDOWN and TILT functions. This can be done by adding the variable *TiltDownOrder* in the postprocessor. If the variable is omitted or set to nil then the TOOLDOWN function will be called before TILT (Normal of safety reason). If the variable is T then the TILT function will be called before the TOOLDOWN.

TOOLUP

This function is only used if the machine has a movable Z-axis that can be controlled from the CNC-file (read more).
It's called every time the tool should be moved up from cutting position to a specified lift height. A function named TOOLUP must be included in the postprocessor.
Following variable is available.

$msg	String	An automatic generated text that describe the reason of Toolup
$fz	Real	The velocity for the rapid speed in mm/min
$stroke	Bool	If the pneumatic stroke should be used
$reason	Int	The reason means following (0=Called if you have a fixed Z) 1=Initialization in the beginning of the file. 2=Between drillings 3=Between markings 4=Between pre-piercings 5=Between cuts in a part 6=Between two parts in cutting 7=After cleaning or pressure educe. 8=If the movement is in 3X. This is the case if you make a tilted rapid in 3D-5X. In this case you should use also $x and $y.
$x	Real	Are used if the toolup are a 3X movement, this is the case when $reason is 8.
$y	Real	Are used if the toolup are a 3X movement, this is the case when $reason is 8.
$z	Real	The lift height in mm. The value is checked against over travel and can't exceed Max Z-axis movement minus the material thickness and the Standoff.

$zmode	Int	The $zmode have following meaning. 0=Fixed Z-axis. 1=Automatic, Up/Down controlled by water On/Off. 2=Up/Down with separate M-codes. 3=Up/Down controlled by Z-coordinates. 4=Automatic Height sensor that are controlled by water On/Off. 5=Height sensor that are controlled by M-codes. 6=Height sensor that are controlled by Z-coordinates. 7=By measuring probe information. If the machine has a pneumatic stroke, then this can be used together with all options above.

Example:

ITS WRONG £mode skulle vara 6 men ger 5

```
(DEFUN toolup()
 (IF $sensor (WRITE (STRCAT (NTXT) "M45 (SENSOR OFF, TOOL UP)")))
 (COND
  ($sensor nil)
  ((= $reason 1)
    (WRITE (STRCAT (NTXT) "G0 Z" (RTS $z) " (TOOL UP IN BEGINNING OF FILE)"))
  ((= $reason 2)
    (WRITE (STRCAT (NTXT) "G0 Z" (RTS $z) " (TOOL UP BETWEEN DRILLINGS)"))
  ((= $reason 3)
    (WRITE (STRCAT (NTXT) "G0 Z" (RTS $z) " (TOOL UP BETWEEN MARKINGS)"))
  ((= $reason 4)
    (WRITE (STRCAT (NTXT) "G0 Z" (RTS $z) " (TOOL UP BETWEEN PRE PIERCINGS)"))
  ((= $reason 5)
    (WRITE (STRCAT (NTXT) "G0 Z" (RTS $z) " (TOOL UP BETWEEN CUTS)"))
  ((= $reason 6)
    (WRITE (STRCAT (NTXT) "G0 Z" (RTS $z) " (TOOL UP AFTER LAST CUT ON PART)"))
 )
)
```

TOOLDOWN

This function should move the tool down to cutting position.

$fz	Real	The velocity for the rapid speed in mm/min
$initdown	Bool	This variable is T the first time the TOOLDOWN function is called else nil
$initpartwice	Bool	This variable can be used only in combination with height sensors and if the sensoring type is Partwice. The variable is T the first time the TOOLDOWN function is called after new part has started, else nil.
$initsheetwice	Bool	This variable can be used only in combination with height sensors and if the sensoring type is Sheetwice. The variable is T the first time the TOOLDOWN is called else nil.
$msg	String	An automatic generated text that describe the reason of Toolup

$reason	Int	The $reason means following: The reason means following 1=Initialization in the beginning of the file. 2=Between drillings 3=Between markings 4=Between pre piercings 5=Between cuts in a part 6=Between two parts in cutting 7=Before cleaning or pressure reduce.
$sensordist	Real	The distance between each measurement when using Stamping sensor. The variable are used to calculate the time between each measurement and are only used in AWJ-cutting.
$sensormode	Int	-1= If no height sensor are in use. 0=Sheetwice. Normal implementation is that the sensor measure the height once at the start. 1=Partwice. Normal implementation is that the sensor measure the height at every new part. 2=Dragging. The height sensor are at the material all time. 3=Stamping. The height sensor measures the height periodical. The time between the measurements are controlled by the variable $sensorsec. See also $sensordist.
$sensorsec	Real	The time between each measurement when using Stamping sensor. The time is calculated from the variable $sensordist and the High cutting speed in Normal quality. This variable is only used in AWJ cutting.
$stroke	Bool	If the pneumatic stroke should be used
$z	Real	This value is the same as previous $z that was used to move up the tool. If the tools have not been down, then the value is the maximum lift height minus the thickness of the material.
$zmode	Int	The $zmode have following meaning. 0=Fixed Z-axis. 1=Automatic, Up/Down controlled by water On/Off. 2=Up/Down with separate M-codes. 3=Up/Down controlled by Z-coordinates. 4=Automatic Height sensor that are controlled by water On/Off. 5=Height sensor that are controlled by M-codes. 6=Height sensor that are controlled by Z-coordinates. 7=By measuring probe information. If the machine has a pneumatic stroke, then this can be used together with all options above.
$zref	Bool/ Int	This variable is an integer that indicate the closest reference point, measured by the measure function. If you haven't used the measure function, this variable is nil.

Example

```
(DEFUN tooldown ()
 (IF $sensor
  (WRITE (STRCAT (NTXT) "M44 (SENSOR ON, TOOL DOWN)"))
  (WRITE (STRCAT (NTXT) "G0 Z0"))))
)
```

Normally the Z-axis is moved to Z0 or to the same value as the material thickness. The $Z value is a negated $Z value specified in the last TOOLUP event.

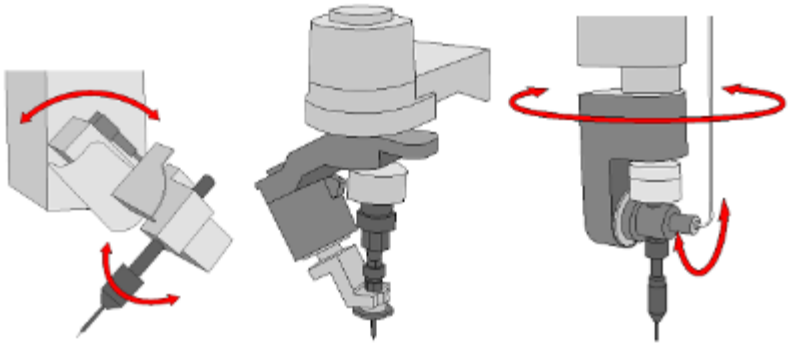
Note! To adjust the order between TILT and TOOLDOWN se the variable *TiltDownOrder* in the description of the TILT function.

Changes in R2016.3.1058

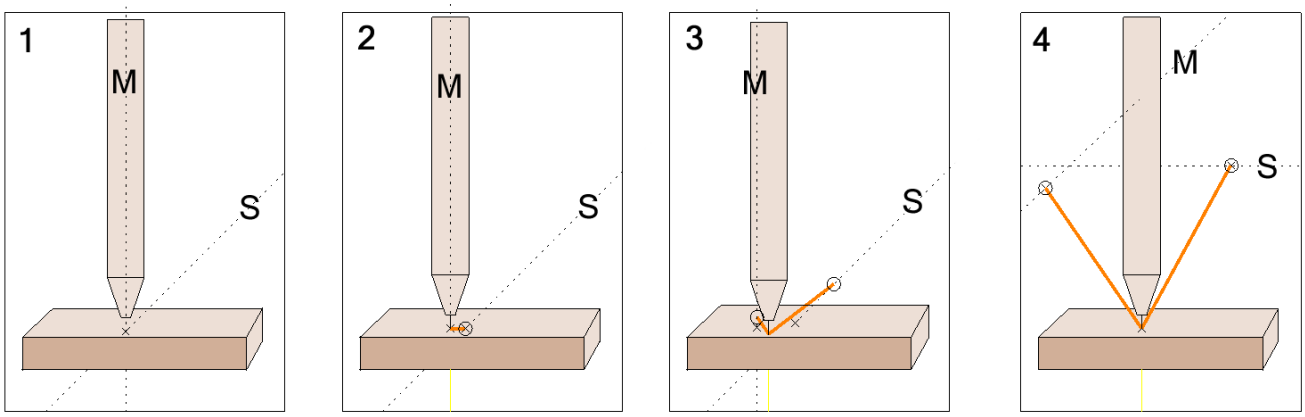
The Tooldown function will never be called when using zmode 0. Unless you don't specify in the postprocessor (SETQ *ZDownOnFixed* T). This can be done in the beginning of the postprocessor.

CALCTOOL5XOFFSET

This function can be used if the controller cannot use RTCP. The absolute best solution is if the RTCP calculation is done in the controller, and the coordinates in the CNC file describe the position of the nozzle. This is a workaround if the controller lack that functionality.



Theoretically this function can be used on all kinematic constructions based on two rotation axes.



M=The major axis vector where the second axis is mounted on. S=Secondary axis vector that are in another direction

Example 1:

Both rotation vectors go exactly thru the Tool Center Point. No modification needs to be done.

Example 2:

The second rotation vector does not go through the TCP. By defining the distance in XYZ from TCP to a point on secondary the function will correct for this "error".

```
(SETQ PointOnMajAxis (LIST 0.0 0.0 0.0)); zero distance
(SETQ PointOnSecAxis (LIST 0.5 0.0 0.0))
```

Note! The distance must be written in millimeters, even if IGEMS is set to inches.
When calculate the distance the both axes should be in zero angle.

Example 3 and 4

In this case both rotations are not correct (they do not intersect exactly with the TCP). Note! The points given can be at any location on the rotation axis.

```
(SETQ PointOnMajAxis (LIST x y z));
(SETQ PointOnSecAxis (LIST x y z))
```

Note! The distance must be written in millimeters, even if IGEMS is set to inches.
When calculating the distance both axes should be in zero angle.

Function call

The variable pp_bevelprim is the vector direction of the major axis. This variable is normally always set by IGEMS internally but can also be redefined in the postprocessor. (Example 0,0,-1)
The variable pp_bevelsec is the vector direction of the secondary axis (Example -1, 0,-1)
The variable $a is the actual rotation of the major axis, $b is the actual rotation of secondary axis.

By inserting following lines in the functions that generate movements the X Y and Z coordinates can be modified to compensate for this error.

```
(IF $ab
 (PROGN
   (SETQ dxyz (CALCTOOL5XOFFSET pp_bevelprim PointOnMajAxis $a pp_bevelsec PointOnSecAxis $b))
   (SETQ $x (- $x (CAR dxyz)) $y (CADR dxyz) $z (CADDR dxyz))))
```

Note that it is always better to use RTCP compensation in the controller if possible.

Variables

Variables that are ornamented with the * signs come from the machine, material or the strategy dialogs. If you want to override the settings in those dialogs then you can add those variables directly in the postprocessor. To do this can be confusing for the user, because when he do changes in those dialogs there is no changing in the final CNC-file. If can also have some good cases since the postprocessor will always produce the same result no matter how the machine or strategy is set. Here is some variables that can be used.

Variable	Type	Meaning
CustomcircularPiercing	T or nil	Set this variable to T if the controller generate the circular movements automatically by an M code or similar.
SupressTrailingZeroes	T or nil	T if trailingzeroes should be removed
SupressTrailingDots	T or nil	T id trailing dots should be removed
HeadPrimaryMaxSpeed	number	Max speed for major axis in degree per second
HeadSecondaryMaxSpeed	number	Max speed for secondary axis in degree per second
HeadType	number	Set the type of kinematic 5-axis head
HeadDir	number	Set the direction of the 5-axis head
HeadTiltAngle	number	The tilt angle of the 5-axis head.
HeadSecondaryReversed	T or nil	If the direction of the rotation should be reversed.

TUBE cutting

About axis names

X and Y is the two major axis of the machine.

Z axis moves the cutting equipment up and down.

A is the primary bevel axis (the axis mounted on the machine)

B is the secondary bevel axis (the axis mounted on the primary axis)

C is the rotation axis of the tube. If (C) then the axis is used only for indexing.

The axis below is describe the axis that can be moved at the same time.

	No C-axis No Bevel head	**C-axis No Bevel head**	**No C-axis Bevel head**	**C-axis Bevel head**
Projected cut	Using: X,Y,Z TUBE-3X	Using: X,Y,Z, (C) TUBE-3X	Using: X,Y,Z TUBE-3X	Using: X,Y,Z (C) TUBE-3X
				Tube6AxisPrefere Using: X,Y,Z,A,B,C TUBE-6X
Projected Out of center	Using: X,Y,Z TUBE-3X	Using: X,Y,Z, (C) TUBE-3X	Using: X,Y,Z TUBE-3X	Using: X,Y,Z (C) TUBE-3X
				Tube6AxisPrefere Using: X,Y,Z,A,B,C TUBE-6X
Projected with tilt (out of center)	Not possible	Not possible	Using: X,Y,Z,A,B TUBE-5X	*Tube6AxisPrefere* Using: X,Y,Z,A,B,C TUBE-6X
				Using: X,Y,Z,A,B (C) TUBE-5X
Rotated cut	Not possible	Using: X,Z,Y,C TUBE-4X	Using: X,Y,Z,A,B TUBE-5X	Using: X,Z,Y,C TUBE-4X
Rotated with tilt	Not possible	Not possible	Using: X,Y,Z,A,B Algorithm: 3 TUBE-5X	Using: X,Y,Z,A,B,C Algorithm 5 TUBE-6X
Cutoff	Not possible	Using: X,Y,Z,C Algorithm: 1 TUBE-4X	Not possible	Using X,Y,Z,C Algorithm: 1 TUBE-4X
Wrap	Not possible	Using: X,Y,Z,C TUBE-4X Algorithm: 1	Not possible	Using: X,Y,Z,C Algorithm: 1 TUBE 4X
Cut off with tilt	Not possible	Not possible	Not possible	Using: X,Y,Z,A,B,C TUBE 6X

(TUBE-DIST <ang1> <pos1> <ang2> <pos2>)

The function calculates the distance between two points on the tube. If <pos1> is not the same as <pos2> and the profile is circular then a helical components is added to the distance calculation. If <ang1> is larger than <ang2> then the distance computation is done counter clockwise, otherwise clockwise. Multiple turns are supported if the absolute difference between <ang1> and <ang2> is more than 2 PI. This function is used internally and will probably not be needed in the postprocessor.

TUBE-CHMODE

This function is called before each new cut and describe the type of next cut.

$reason	int	1: Next cut will be using TUBE-3X functions 2: Next cut will be using TUBE-4X functions 3: Next cut will be using TUBE-5X functions 4: Next cut will be using TUBE-6X functions

TUBE-3X

This function is used to move the jet in 3 axis X, Y and Z. No rotation of the jet will be used in this cutting

$fe	Real	The speed as distance/minute if you have tube axis as a linear axis
$fe	Real	The speed in distance/minute
$ft	Real	The speed as time for the movement
$x	Real	The position of the X-axis.
$y	Real	The position of the Y-axis.
$z	Real	The position of the Z-axis.

TUBE-4X

This function is used to move the jet in 4 axis in same timeC, X, Y and Z.

$c	Real	The rotation angle of the tube in radians.
$fe	Real	The speed as distance/minute if you have tube axis as a linear axis
$ft	Real	The speed as time for the movement.
$x	Real	The position of the X-axis.
$y	Real	The position of the Y-axis.
$z	Real	The position of the Z-axis.

TUBE-5X

The function is used to move the tool in interpolation up to 5-axis at the same time. The jet is always active when this function is called, the tube is never moved.

$a	Real	The angle of primary axis of the bevel head in radians.
$ab	Bool	This variable is nil if no 5-axis information are available else T.
$b	Real	The angle of the secondary axis of the bevel head in radians.

$fe	Real	The speed as distance/minute if you have tube axis as a linear axis
$ft	Real	The speed as time for the movement
$x	Real	The position of the X-axis.
$y	Real	The position of the Y-axis.
$z	Real	The position of the Z-axis.

TUBE-X6

The function is used to rotate the tube or (and) move the tool while cutting on the tube. The jet is always active when the function is called.

$a	Real	The angle of primary axis of the bevel head in radians.
$ab	Bool	This variable is nil if no 5-axis information are available else T.
$b	Real	The angle of the secondary axis of the bevel head in radians.
$c	Real	The angle of the tube rotation
$ft	Real	The speed as time for the movement
$fe	Real	The speed as distance/minute if you have tube axis as a linear axis
$x	Real	The position of the X-axis.
$y	Real	The position of the Y-axis.
$z	Real	The position of the Z-axis.

TUBE-CUTOFF

The function should be used to turn the jet off.

TUBE-CUTON

The function should be used to turn the jet on. For the moment we are only use start with blind lead.

TUBE-DOWN

The function are called when moving the tool down to a non-flat work piece.

$z	Real	The position of the Z-axis.

TUBE-RAPID

The function are called when moving the tool in rapid move while cutting on a non-flat work piece

$y	Real	The position of the Y-axis.
$z	Real	The position of the Z-axis.

TUBE-ROTATE

This function is used to rotate the tube (indexing) to a new position. The cutting is never active and the nozzle is always away from the tube when this function is called. The speed is always the highest possible.

$c	Real	The angle in radians of the rotation major axis. If no 5-axis equipment are in use this variable is always 0.

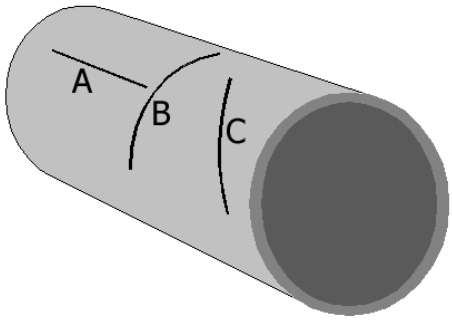
TUBE-UP

The function are called when the tool are moving up.

$z	Real	The position of the Z-axis.

Cutting speed on tube cutting

The cutting speed on tube cutting must be handled in a different way compared with normal shape cutting in X and Y. The reason is that the tube rotation is usually programmed as a rotation axis in degree per minute and the other movement is programmed in distance/minute.



When you cut the A geometry there is no rotation of the tube, in this case is possible to use distance/minute programming. When cutting B the only movement is the tube rotation and in this case it's possible to use speed in degree/ minute. The C geometry is a mix of A and B and in this case it's not possible to use either speed by distance/minute or degree/minute.

Invers time feed rate definition

The feed rate should be programmed in invers time and it's solves the problem when the numerical control must mix different methods. The speed is entered as inverse time for the CNC-controller to finish the block. Since the value can differ al lot between each block it's important to enter the value on all block that are programmed with invers feed rate definition.
FDM=Feed in mm or inches per minute.
D=Path length in mm or inches per minute.

F=FDM/D
Example:
N200 G93 G1 X100 F2
The time to traverse along the programmed path is 0.5 min. Wanted feed rate is 200mm/min.
200/100=2
The variable $ft can be used in all TUBE functions. The value stored in the variable is the time it should take for the controller to finish the block. To change this value to invers time just divide 1/time
Example

```
(DEFUN tube-4X (/ ivt)
 (SETQ ivt (/ 1 $ft))
 (WRITE (STRCAT "G1 X" (RTS $x) " Y" (RTS $y) " Z" (RTS $z) " C" (ATS $c) " F" (RTOS ivt 4)))
)
```

The invers time feed rate definition method may not be supported on all CNC-controller and it may have different G-codes. In many controllers this function can be activated by the G-code G93.

Specify the tube axis as a linear axis

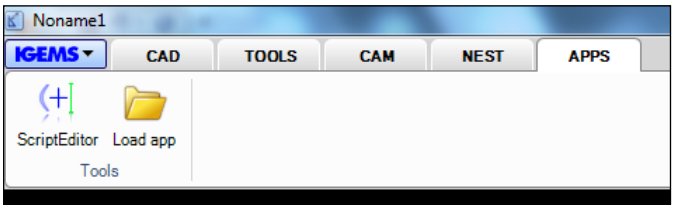
If your CNC-controller does not support invers time feed rate definition than you can set up the tube axis as a linear axis. In this case one lap on the tube axis is the same as moving the linear axis 360 mm. If you have another ratio this must be specified in the postprocessor. This can be done by including following line in the beginning of the postprocessor.
Example:

```
(SETQ *TubeLap* 100.0)

(DEFUN tube-rotate ()
  (WRITE (STRCAT "G1 C" (RTS 100.0) " F" (RTF $fe)))
)
```

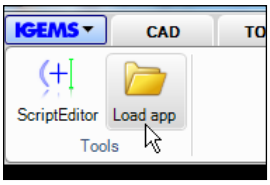
If you do like this the IGEMS will calculate all cutting speeds and it’s possible to use the normal method (distance/minute) of handling the cutting speed.

Apps

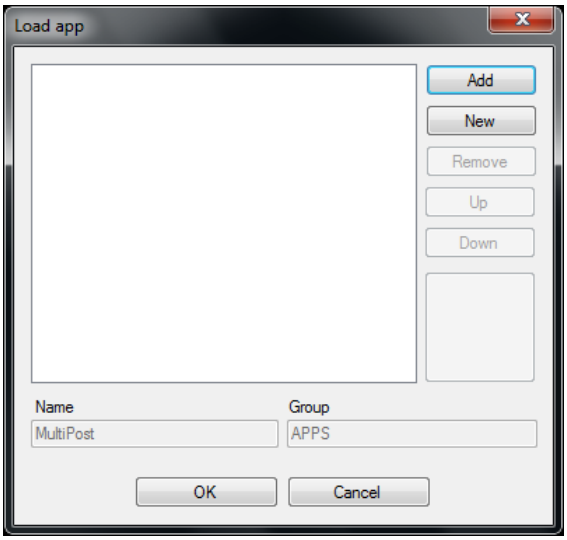


This information describe how to develop special applications and commands for IGEMS by using the programming language ILISP as developer tools. ILISP is normal text files that can be added to the system by the function Load app

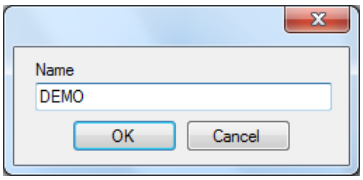
Load app



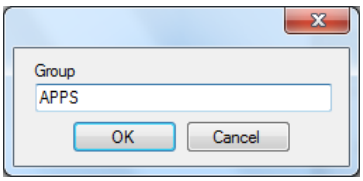
Start this command and the following dialog box is shown:



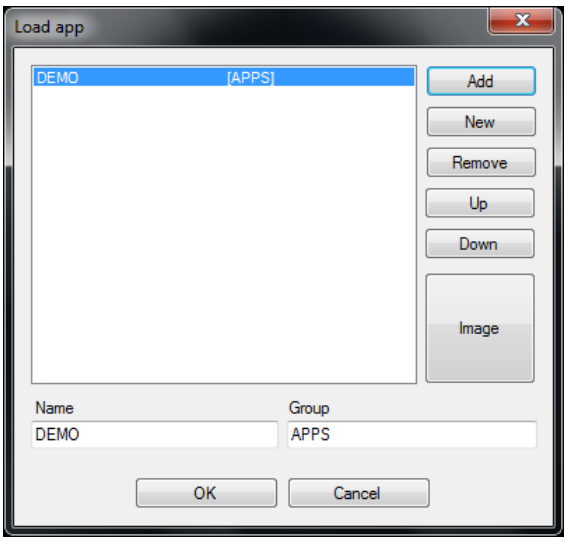
Press the "Add" button and select the LSP file to add. A small sample is in the APP folder in IGEMS program directory.
Select ….\APP\ANIMALDEMO\ANIMALDEMO.LSP



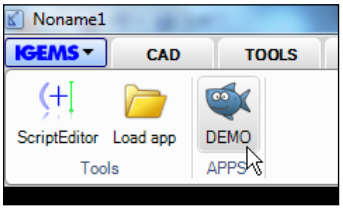
Give the application a name.



The applications can be grouped together on the menu.

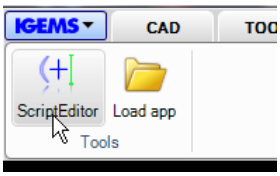


Press the "Image" button and select an image in the same folder as the LSP file. Click "OK to load the first application.

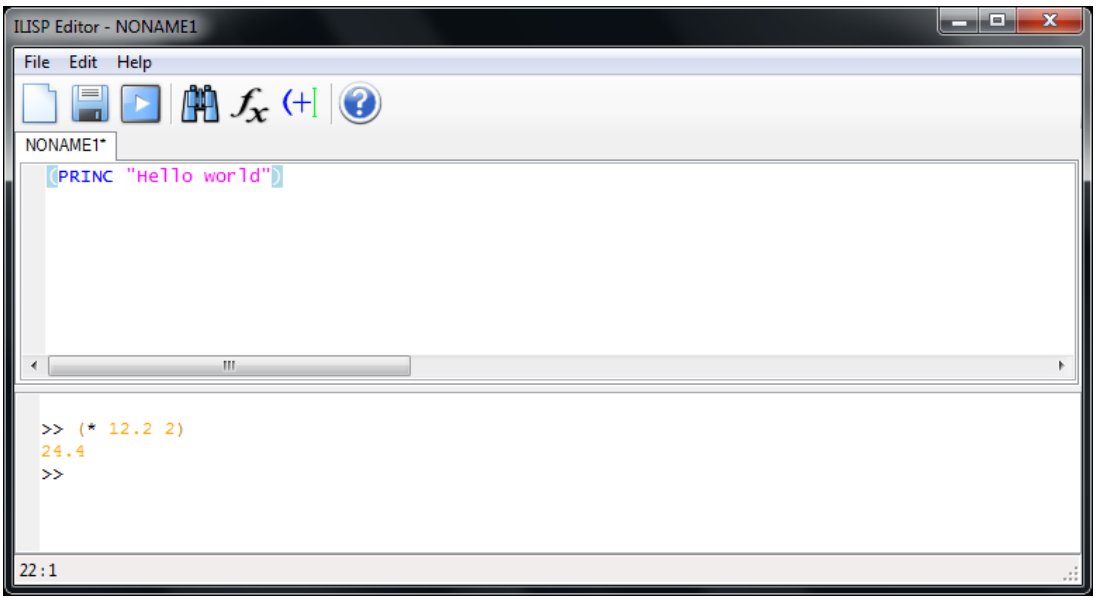


This is just an example on how to load apps.

Script editor

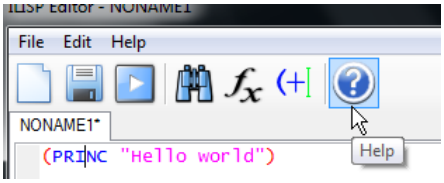


ILISP has an inbuilt editor to makes it possible to create and edit ILISP files.



The first area is for writing the code, the second area is a console where you can type and check ILISP functions.

The console area can be minimized by clicking on the button above.



By setting the marker on a reserved ILISP word and press F1 or the Help button you can view a description of all ILISP commands.

ILISP Functions

Data types in ILISP
ILISP supports following data types:
* lists
* symbols
* strings
* real numbers
* integers
* file descriptors
* subrs (built-in functions)

ILISP provides numerous predefined functions. Each function is called by giving its name (upper or lower case) as the first element of a list, with the arguments to that function (if any).

(- <number> <number> ...)
This function subtracts the second <number> from the first and returns the difference. If more than two <number> are given, the sum of the second through last is subtracted from the first, and the final result is returned. If only one <number> is given, the result of subtracting it from zero is returned. This function may be used with reals or integers.

(- 50 40)	returns 10
(- 40 40.0 2)	returns 8.0
(- 50 40.0 2.5)	returns 7.5
(- 8)	returns -8
(- -8)	returns 8

(* <number> <number> ...)
This function returns the product of all <number>. It may be used with reals or integers.

(* 2 3)	returns 6
(* 2 3 4.0)	returns 24

(/ <number> <number> ...)
This function divides the first <number> by the second and returns the quotient. If more than two numbers are given, the first number is divided by the product of the second through last, and the final quotient is returned. This function may be used with reals or integers.

(/ 100 2)	returns 50
(/ 120 2.0)	returns 60.0
(/ 200 20 2.0)	returns 5.0

(/= <atom1> <atom2>)
This is the "not equal to" relational function. It returns T if <atom1> is not numerically equal to <atom2> and nil if the two atoms are numerically equal. The function is valid for numbers and strings.

(/= 12 12)	returns nil
(/= 22 4.0)	returns T
(/= "ABC" "ABC")	returns nil
(/= "yes" "no")	returns T
(/= "text" 12)	returns T

(+ <number> <number> ...)

This function returns the sum of all <number>. It may be used with reals or integers. If all the <number> are integers, the result will be an integer; if any of the <number> are real's, the integers will be promoted to real's and the result will be a real.

(+ 1 2)	return 3
(+ 1 2 3 4.5)	return 10.5
(+ 1 2 3 4.0)	return 10

(< <atom> <atom> ...)

This is the "less than" relational function. It returns T if the first <atom> is numerically less than the second and nil otherwise. If more than two atoms are given, T is returned if each atom is less than the <atom> to its right. The function is valid for numbers and strings.

(< 22 21)	returns nil
(< 10 20)	returns T
(< 1 2 3)	returns T
(< 3 1 2)	returns nil
(< "a" "b")	returns T

(<= <atom> <atom> ...)

This is the "less than or equal to" relational function. It returns T if the first <atom> is numerically less than or equal to the second, and nil otherwise. If more than two atoms are given, T is returned if each atom is less than or equal to the <atom> to its right. The function is valid for numbers and strings.

(<= 10 11)	returns T
(<= 99 50.0)	returns nil
(<= 10 10.0 11)	returns T
(<= 99 1 2 3)	returns nil
(<= "a" "A")	returns T
(<= "AB" "AC")	returns T
(<= "a" "b" "a")	returns nil

(= <atom> <atom> ...)

This is the "equal to" relational function. It returns T if all the specified atoms are numerically equal, and nil otherwise. This function is valid for numbers and strings.

(= 18.0 18)	returns T
(= 42 19)	returns nil
(= "ABC" "abc")	returns nil
(= "lisp" 14.78)	returns nil

(> <atom> <atom> ...)

This is the "greater than" relational function. It returns T if the first <atom> is numerically greater than the second and nil otherwise. If more than two atoms are given, T is returned if each atom is greater than the <atom> to its right. The function is valid for numbers and strings.

(> 19 17)	returns T
(> 1 20.0)	returns nil
(> 5 3 1)	returns T
(> "A" "B")	returns nil
(> "a" "A")	returns T

(>= <atom> <atom> ...)

This is the "greater than or equal to" relational function. It returns T if the first <atom> is numerically greater than or equal to the second and nil otherwise. If more than two atoms are given, T is returned if each atom is greater than or equal to the <atom> to its right. The function is valid for numbers and strings.

(>= 80.0 14)	returns T
(>= 10 110.0)	returns nil
(>= 11.1 10.2 4)	returns nil
(>= "B" "A")	returns T

(1- <number>)

This function returns <number> reduced by 1,<number> may be a real or an integer.

(1- -5)	returns -6
(1- 17.5)	returns 16.5

(1+ <number>)

This function returns <number> increased by 1 <number> may be a real or an integer.

(1+ 12)	returns 13
(1+ 99.0)	returns 100.0

(ABS <number>)

This function returns the absolute value of <number>, <number> may be a real or an integer.

(ABS 44)	returns 44
(ABS -72.2)	returns 72.2

(ACOS <number>)

This function returns the result of the inverse cosine function as radians.

(ACOS (/ 100.0 107.7))	returns 0.38499

For more information see the Geometrical example.

(ALERT <string>)

This function shows a message box with the text <string>

(ALERT "Press Enter")

(AND <expr> ...)

This function returns nil if any of the expressions evaluate to nil, otherwise it returns T.

(AND 20.0 -1 T "A")	returns T
(AND 1 T nil)	returns nil

The function is often used together with the CASE or IF function.

(ANGLE <ptl> <pt2>)

This function returns the angle between the two points. The result is returned in radians, with angles increasing in the counterclockwise direction. Zero degree is in IGEMS X positive direction.

```
(SETQ pt1 (LIST 0.0 0.0))
(SETQ pt2 (LIST 100.0 50.0))
```

```
(ANGLE pt1 pt2)          returns 0.463648
(ANGLE pt2 pt1)          returns 3.60524
```

For more information see the Geometrical example.

(ANGDIFF <angle1> <angle2>)

The function takes two angles in radians and returns the shortest difference between the angles. The result is always a real value between –PI to +PI.

```
(SETQ a1 PI)
(SETQ a2 (- PI))
(ANGDIFF a1 a2)          returns 0

(SETQ a3 (* PI 7))
(ANGDIFF a3 a1)          returns 0

(ANGDIFF 0.1 -0.1)       returns -0.2
(ANGDIFF -0.1 0.1)       returns 0.2
(ANGDIFF 3.14 2)         returns -1.14
```

For more information see the Geometrical example.

(ANGTOS <angle> <precision> [raw])

The function takes <angle> (a real, in radians) and returns it edited into a string. The argument <precision> control the number of digits. If the optional argument [raw] is T then the function can returns also negative values. If the argument [raw] is omitted or nil then the function returns only positive angles between 0 to 360.

```
(ANGTOS PI 3)            returns "180.000"
(ANGTOS (- PI) 0)        returns "180"
(ANGTOS (- PI) 0 T)      returns "-180"
(ANGTOS (* PI 4) 1 nil)  returns "0.0"
(ANGTOS (* PI 4) 1 T)    returns "720.0"
(SETQ pt1 (LIST 0.0 0.0))
(SETQ pt2 (LIST 0.0 100.0))
(SETQ a (ANGLE pt1 pt2))
(ANGTOS a 3)             returns "90.000"
(ANGTOS a 1)             returns "90.0"
```

(APPEND <expr> ...)

This function takes any number of lists <expr> and runs them together as one list.

```
(APPEND (LIST a b) (LIST 1 d))      returns (A B 1 D)
(APPEND '((a) (b)) '((c d)))        returns ((A) (B) (C) (D))
```

(APPLY <function> <list>)

Executes the function specified by <function> with the arguments given by <list>.

```
(APPLY '+ '( 9 5 3))                                  returns 17
(APPLY 'STRCAT (LIST "A" "b" "c" "-123"))     returns "AbC-123"
```

APPLY works with both built-in functions (subrs) and user-defined functions (those created with either DEFUN or LAMBDA).

(ASCII <string>)

This function returns the conversion of the first character of <string> into its Unicode character code (an integer).

```
(ASCII "A")              returns 65
(ASCII "-")              returns 45
```

```
(ASCII "6")                    returns 54
(ASCII "ABCDE")                returns 65
```

(ASIN <number>)

This function returns the result of the inverse sinus function as radians.

```
(ASIN (/ 40.0 107.7))          returns 0.38499
```

For more information see the Geometrical example.

(ASSOC <item> <associationlist>)

This function searches the association list for <item> as the key element and returns the entry. If <item> is not found as a key in associationlist then the function returns nil.

```
(SETQ alist (LIST (LIST "JAN" 31) (LIST "FEB" 28) (LIST "MAR" 31) (LIST "APR" 30)))
(ASSOC "JAN" alist)            returns ("JAN" 31)
(ASSOC "APR" alist)            returns ("APR" 30)
(ASSOC "JUN" alist)            returns nil
```

(ATAN <num1> [<num2>])

If <num2> is not supplied, ATAN returns the arctangent of <num1> in radians. <Num1> can be negative. The range of angles returned is from -PI to +PI radians.

```
(ATAN 0.5)                     returns 0.463648
(ATAN -1.0)                    returns -0.785398
(ATAN 1.0)                     returns 0.785398
```

If both <num1> and <num2> are supplied, the arctangent of <num1/<num2> is returned, in radians. If <num2> is zero, an angle of plus or minus 1.570796 radians (+90° or -90°) is returned, depending on the sign of <num1>

```
(ATAN 2.0 3.0)                 returns 0.588003
(ATAN 2.0 -3.0)                returns 2.55359
(ANGTOS (ATAN 2.0 -3.0) 4) returns "146.3099"
(ATAN 1.0 0.0)                 returns 1.5708
```

For more information see the Geometrical example.

(ATOF <string>)

This function converts a string to a real value.

```
(ATOF "-44")                   returns -44.0
(ATOF "0")                     returns 0.0
(ATOF "TEXT")                  returns 0.0
(ATOF "123.5TEXT")             returns 123.5
```

(ATOI <string>)

This function converts a string to an integer.

```
(ATOI "9.5")                   returns 9
(ATOI "-44")                   returns -44
(ATOI "TEXT")                  returns 0
```

(ATOM <item>)

This function returns nil if <item> is a list and T otherwise. Anything that's not a list is considered an atom.

```
(ATOM nil)                    returns T
(ATOM T)                      returns T
(ATOM "TEXT")                 returns T
(ATOM (LIST 1 2))             return nil
(ATOM '+)                     return T
```

(ATOMS-FAMILY <format> [<search-list>])

This function returns a list with all symbol names. If the <format> value is 0 then the list is a list of symbol names. If the <format> value is 1 then the symbol name are converted to strings. The <search-list> should be a list of strings that specify the symbol names you want atoms-family to search for.

```
(ATOMS-FAMILY 0)                          returns (+ - * / = APPEND ASCII ...)
(ATOMS-FAMILY 1)                          returns ("+" "-" "*" "/" ...)
(ATOMS-FAMILY 1 (LIST "+" "NOTEXIST")))   returns ("+" "nil")
```

(BEEP [condition [sound]])

This function plays one of windows standard sound. The condition must be a non nil value if the sound should be used.
The function returns the condition value. If no condition value is used then the function return T.
If no sound information is given then the function use sound number 2.
The sound value is an integer with following meaning.

Sound	
0	Exclamation
1	Asterisk
2	Beep (default)
3	Hand
4	Question

Note! The sound may differ from the information above since the sound can be changed in the control panel.

```
(BEEP)                        returns T and sound 2
(BEEP nil)                    returns nil
(BEEP (IF (> 2 1) "Yes" nil)) returns "Yes" and sound 2
(BEEP 1 3)                    returns 1 and sound 3
(BEEP T 99)                   returns T and sound 2
```

The function can for example be used to indicate input error in dialogs.

(BOUNDP <atom>)

The function returns T if <atom> has a value bound to it. If no value is bound to <atom> it returns nil.

```
(SETQ a 1 b nil)
(BOUNDP 1)                    returns nil
(BOUNDP 'a)                   returns T
(BOUNDP 'b)                   returns nil
```

(CADDR <list>)

The function returns the third object in the list

```
(CADDR '(101 102 103))                    returns 103
(CADDR '((100 101 102) (a b c)) (d)))     returns (d)
```

For more information see the list section.

(CADR <list>)

The function returns the second object in the list

(CADR '(101 102 103 104)) returns 102
(CADR '((100 101 102) (a b c))) returns (a b c)

For more information see the list section.

(CAR <list>)

The function returns the first object in the list.

(CAR '(100 101 102)) returns 100
(CAR '((1 2) 100 200)) returns (1 2)
(CAR '()) returns nil

For more information see the list section.

(CDR <list>)

This function returns the list without the first object in the list.

(CDR '(100 101 102)) returns (101 102)
(CDR '((100 101) a b)) returns (a b)
(CDR '()) returns nil

When the list argument is a dotted pair, CDR returns the second element without the list.

(CDR '(1 . 100)) returns 100
(CDR '(2 . "INFO")) returns "INFO"

For more information see the list section.

(CEIL <number>)

The function round up the value to closest value.

(CEIL 1.1) returns 2.0
(CEIL -18.9) returns -18.0

(CHR <number>)

This function returns a character that represents that Unicode value. The <number> can be any integer value from 0 to 65535.

(CHR 65) returns "A"
(CHR 66) returns "B"
(CHR 333) returns "ō"

(CIRCLE3D3P <3dpoint> <3dpoint> <3dpoint>)

This function takes 3 3D points in space and returns a list of two lists. The first list is the 3D-center point and the second is a 3D-direction vector describing the normal from the circle plan.

(CIRCLE3D3P '(0 0 0) '(10 20 30) '(2 34 32)) returns
((-6.97219 22.49272 10.66225) (-0.69148 -0.47312 0.54591))

Since there are two direction vectors that are correct you may to negate values if it should be use to describing the axis vectors in 5-axis kinematic.

(CLIP-GET)

This function returns a string with the contents of the clip board. With this function you can for example import information from excel.

(CLIP-SET <text>)

The function copy the <text> to the windows clipboard.

(CLOSE <file>)

This function closes a file and returns nil. <file> is a file descriptor obtained from the OPEN function. After a CLOSE, the file descriptor is unchanged, but is no longer valid.

```
(SETQ wfile (OPEN "c:/test/test.txt" "w")
(WRITE-LINE "First line" wfile)
(WRITE-LINE "Second line" wfile)
(CLOSE wfile)                          returns nil
```

(CLS)

Clear the postprocessor console from all text

(COND (<test1> <execute1>) (<test2> <execute2) ...)

This function accepts any number of arguments. It evaluate the first item in each list until one of then returns a value other than non nil. It then evaluate those expressions which follow the tests that succeeded, and returns the value of the last expression.

```
(SETQ nr 1)
(COND
 ((= nr 0) (PRINC "Number is zero"))
 ((= nr 1) (PRINC "Number is one"))
 (T      (PRINC "Number is not zero or one"))
)
```

(CONS <new> <list>)

This function adds a new element in the beginning of the list and returns the complete new list.

```
(CONS 10 '(20 30 40))                  returns (10 20 30 40)
(CONS a nil)                           returns (a)
(CONS '(a b) '(10 20 30))              returns ((a b) 10 20 30)
```

CONS also accept an atom in place of the <list> argument, constructing a structure known as a dotted pair. When displaying a dotted pair, ILISP prints a period, or dot, between its first and second elements. The CDR function can be used to return the second atom of a dotted pair.

```
(CONS 'B 22)                           returns (B . 22.0)
(CAR (CONS 'B 22)                      returns B
(CDR (CONS 'B 22)                      returns 22
```

A dotted pair is a special kind of list, and is not accepted as an argument by some functions that handle ordinary lists.

(COS <angle>)

This function returns the cosine of <angle>, where <angle> is expressed in radians.

```
(COS 0.0)                    returns 1.0
(COS PI)                     returns -1.0
(COS (* PI 0.5))             returns 0.0
```

For more information see the Geometrical example.

(DATE)

The function returns a list with year month day.

```
(DATE)                       returns (2013 11 16)
```

See also the time function

(DEFUN <name> <argument list> <expressions> ...)

DEFUN defines a function with the name <name> (note that the function name is automatically Quoted and must not be explicitly Quoted). Following the function name is a list of arguments (possibly void), optionally followed by a slash and the names of one or more local symbols for the function. The slash must be separated from the first local symbol and from the last argument, if any, by at least one space. If no arguments or local symbols are to be declared, an empty set of parentheses must be supplied after the function name.

```
(DEFUN sample (a b)...)          this function takes two arguments
(DEFUN sample ()                 this function have no argument
(DEFUN sample (/ local1 local2)  this function have two local variables.
(DEFUN sample (a / local)        this have one argument and one local variable
```

Following the list of arguments and local symbols are one or more expressions to be evaluated when the function is executed. The DEFUN function itself returns the name of the function being defined. The local symbols may be used within the function without changing their bindings at outer levels. The function will return the result of the last expression evaluated. All previous expressions in the function have only side effects. The DEFUN function itself returns the name of the function defined.
Never use the name of a built-in function or symbol as <name> since this will make the built-in functions inaccessible.

(DEGTORAD <degree>)

This function convert the <degree> angle to the same value as radians. See also the function RADTODEG

(DISTANCE <pt1> <pt2> [force2D])

This function returns the distance between the points <pt1> and <pt2>. The two points can have any number of dimensions. If the optional argument [force2D] is T then the function returns a 2D distance even if the point arguments are in 3D.

```
(SETQ p1 (LIST 0.0 0.0))
(SETQ p2 (LIST 100.0 100.0))
(DISTANCE p1 p2)                 returns 141.421
(DISTANCE p1 p1)                 returns 0.0
(DISTANCE (LIST 100.0 0) p1)     returns 100.0
(SETQ p3 (LIST 0 1 2 3 4))
(SETQ p4 (LIST 5 6 7 8 9))
(DISTANCE p3 p4)                 returns 11.18034
```

For more information see the Geometrical example.

(DISTOF <expr> [min [max]])

This function takes a string or a numerical value as expr.
If the expr is a string then the function works as follows:

If the string can be converted to a numerical value and the value is between min and max then the function returns that numerical value else it returns nil
If the expr is a numerical value and the value is between min and max then the function returns that value else it returns nil.
If argument min is nil than the function does not check for a min value.
If the argument max is nil than the function does not check or a max value.

```
(DISTOF nil)                    returns nil
(DISTOF T)                      returns nil
(DISTOF "120.2")                returns 120.2
(DISTOF "120.2" 100 200)        returns 120.2
(DISTOF "120.2" 121 200)        returns nil
(DISTOF "120.2" 110 120)        returns nil
(DISTOF 12)                     returns 12
(DISTOF 12 -20 20)              returns 12
(DISTOF -22 -20 20)             returns nil
(DISTOF (LIST a b))             returns nil
(DISTOF "120.2" nil nil)        returns 120.2
(DISTOF "120.2" 130 nil)        returns nil
(DISTOF "120.2" nil 120)        returns 120.2
(DISTOF "120.2" 120 121)        returns 120.2
```

The distof function is often used when programming dialog boxes.

(DOSTR <str> <on error>)

The function is similar to the load function but takes a string as input instead of a file. If something goes wrong then the function <on error> is called.

(ENVGET <key>)

This function can be used to read operation system environment variables.
Example:

```
(ENVGET "WINDIR")               returns "C:/WINDOWS"
```

(ENVSET <key> <value>)

This function can create or modify operating system variables
Example:

```
(ENVSET "PATH" (STRCAT (ENVGET "PATH") ";C:\\MYTEMP")
```

(EQ <expr1> <expr2>)

This functions determines whether <expr1> and <expr2> are identical; that is, they are actually bound to the same object (by SETQ, for example). EQ returns T if the two expressions are identical, and nil otherwise. It is typically used to determine whether two lists are actually the same.

```
(SETQ l1 '(a b c))
(SETQ l2 '(a b c))
(SETQ l3 l2)
(EQ l1 l3)                      returns nil (l1 and l3 are not the same list)
(EQ l2 l3)                      returns T (l2 and l3 are exactly the same list)
```

See also the EQUAL function

(EQUAL <expr1> <expr2> [<fuzz>])

This function determines whether <expr1> and <expr2> are equal, that they should evaluate to the same thing.

```
(SETQ l1 '(a b c))
(SETQ l2 '(a b c))
(SETQ l3 l2)
(EQUAL l1 l3)          returns T (l1 and l3 are evaluated to the same thing)
(EQUAL l2 l3)          returns T (l2 and l3 are exactly the same list)
```

Whereas two lists that are EQUAL may not be EQ, atoms that are EQUAL are always EQ as well. In addition, any two lists or atoms that are EQ are always EQUAL.

When comparing two real numbers (or two lists of real numbers, as in points), it is important to realize that two "identical" numbers may differ slightly if different methods were used to calculate them. Therefore, an optional numeric argument, <fuzz>, lets you specify the maximum amount by which <expr1> and <expr2> can differ and still be considered EQUAL.

```
(SETQ a 1.123456)
(SETQ b 1.123459)
(EQUAL a b)            returns nil
(EQUAL a b 0.01)       returns T
(SETQ p1 (LIST 0.1 100.1))
(SETQ p2 (LIST 0.2 99.9))
(EQUAL p1 p2)          returns nil
(EQUAL p1 p2 0.5)      returns T
(EQUAL nil 91 0.1)     returns nil
```

Functions to read or write operating system environment variables.

(ENVGET key)

(ENVSET key value)

Example:
(envset "PATH" (strcat (envget "PATH") ";c:\\temp\\"))

(EVAL <expr>)

Returns the result of an evaluation.

```
(SETQ a -2.0)
(EVAL 99.9)            returns 99.9
(EVAL a)               returns -2.0
(EVAL (ABS a))         returns 2.0
```

```
(SETQ var7 199.98)
(SETQ index 7)
(PRINC (EVAL (READ (STRCAT "VAR" (ITOA index)))      returns 199.98
```

See also the SET function

(EXP <number>)

This function returns e raised to the <number> power (natural antilog). It returns a real.

```
(EXP 1. 0)             returns 2.71828
(EXP 2.2)              returns 9.02501
(EXP -0.4)             returns 0.67032
```

(EXPT <base> <power>)

This function returns <base> raised to the specified <power>. If both arguments are integers, the result is an integer. Otherwise, the result is a real.

(EXPT 10 2) returns 100
(EXPT 10 3) returns 1000 and is the same as (* 10 10 10)

For more information see the Geometrical example.

(FILE-COPY <source> <target> <overwrite>)

The function copy a file from source to target.

(FILE-DELETE <file name>)

The function deletes the file if it exists. You can't delete more than one file at a time. It's not possible to use "*".

(FILE-DELETE "c:/ncdata/100.cnc") returns T if the file exists and it was deleted, else the function returns nil

(FILE-DIRONLY <file name>)

The function returns the path part from the filename. The last character is always a "/" or "\\"

Example:
(FILE-DIRONLY "C:/NCDATA/MACHINE2/CNC/1008.CNC") returns "C:/NCDATA/MACHINE2/CNC/"

(FILE-EXISTS <file name>)

(FILE-FINDALL <path> <mask> [<subfolders>])

Create a list of all files specified. If the optional argument <subfolder> is T then all files in the subfolders is also collected to the list.

(FILE-MAKEDIR <path>)

Create a directory or multiple directories. The function returns the <path> if success or nil if the function did not success.

(FILE-NAMEONLY <file path> [<remove ext>])

This function returns the file name part from a complete long filename including drive path and extension. In ILISP you can use forward slash instead of backwards slash. The optional argument <remove ext> can be included as a non nil value if you want to remove the extension.

Example:
(FILE-NAMEONLY "C:/NCDATA/MACHINE2/CNC/1008.CNC") returns "1008.CNC"
(FILE-NAMEONLY "C:/NCDATA/MACHINE2/CNC/1008.CNC" T) returns "1008"
(FILE-NAMEONLY "C:/NCDATA/MACHINE2/CNC/1008.CNC" nil) returns "1008.CNC"
(SETQ a 100)
(FILE-NAMEONLY "C:\\NCDATA\\MACHINE2\\CNC\\1008.CNC" (= a 100)) returns "1008"

(FILE-OPENDIALOG <initdir> <filter>)

This function shows a windows open dialog with preview area. The function GETFILED is a similar function that may be removed in the future.
<initdir> is the initial directory for the open dialog. If you want windows to decide then leave this argument as an empty string "".
<filter> Must be a string. The first part is what should be shown as information, the second part is the filter.

Example:

(FILE-OPENDIALOG "" "All important files|*.NC;*.CNC")

The example above will ask for a file with extension ".NC" or ".CNC"

(FILE-READLINES <file name>)

Will open the file and read all strings to a list. The list will be returned.
If the files does not exists then the function returns nil

(FILE-SAVEDIALOG <initdir> <ext>)

The function show a windows save as dialog. The function GETFILED is a similar function that may be removed in the future.
<initdir> is the initial directory for the dialog.
If you want windows to decide then leave this argument as an empty string "".
If you include a filename, then this filename will be default.
If you include
<ext> is the default extension of the file to save.

```
(FILE-SAVEDIALOG "c:/ncdata/" "txt")   returns nil or filename
(FILE-SAVEDIALOG "test.txt" "txt")     returns nil or the filename
(FILE-SAVEDIALOG "c:/ncdata/test.txt" "txt")  returns nil or filename
(FILE-SAVEDIALOG "c:\\ncdata\\test.txt" "txt")        returns nil or filename
```

(FILE-TIME <file name>)

The function returns the complete time for the last change of the file. If the file does not exists then the function returns nil.

```
(FILE-TIME "c:/ncdata/104.pgm"))      "2017-03-08 09:50"
```

(FIX <number>)

This function returns the conversion of <number> into an integer. <number> may be either an integer or a real. If real, it is truncated to the nearest integer by discarding the fractional portion.

```
(FIX 22)                    returns 22
(FIX 11.9)                  returns 11
(FIX -11.9)                 returns -11
```

(FLOAT <number>)

This function returns the conversion of <number> into a real, <number> may be either an integer or a real.

```
(FLOAT 12)                  returns 12.0
(FLOAT 19.8)                returns 19.8
```

(FOREACH <var> <list> <expr>...)

This function steps through <list> assigning each element to <var>, and evaluates each <expr> for every element in the list (or string see below). Any number of <expr> can be specified. FOREACH returns the result of the last <expr> evaluated.

```
(FOREACH s (LIST 10 " "20 " " 30) (PRINC s))
```

The result of this FOREACH should be 10 20 30. The functions return 30
ILISP also support a string instead of a list.

```
(FOREACH s "ILISP" (PRINC s))
```

The result of this FOREACH should be "I" "L" "I" "S" "P". This variant is powerful to use when parsing textstrings.

(GC)

This command makes global garbage collect in the whole IGEMS.

(GCD <num1> <num2>)

This function returns the greatest common denominator of <num1> and <num2>. Both argument must be non zero integers. The result is the largest positive integer that divides the numbers without a remainder.

(GCD 12 4) returns 4
(GCD 4 8) returns 4
(GCD 8 3) returns 1
(GCD 25 5) returns 5

(GETDIR <default> [<flag>])

This function open a dialog where the user can select a directory.

Flag	Meaning
1	If the flag is 1 then the user can create a new directory

The function return nil if the user close the dialog or the selected directory.

(GETDIR "") returns the selected directory for example "C:/NCDATA/"

(GETFILED <Prompt> <default> <extension> <flag>)

Note! This function may be removed in the future.
Please use the function FILE-OPENDIALOG or FILE-SAVEDIALOG instead of GETFILED
The function opens a file dialog and asks for a file name.
The <prompt> argument must be a string and it will be displayed as the label of the file dialog.
The <default> argument can be a complete path file name and extension. If the argument is a filename only then current windows path is used.
The <extension> argument should be without dot, and if it's an empty string then it's means the same as (*).
The <flag> argument is a bit coded integer value with following meaning:

Flag	Meaning
1	Create a file new file. If this bit is not set then the function ask for an existing file.
2	
4	Let the user enter an arbitrary file name extension, or no extension at all *
8	If this bit is set and bit 0 is not set, the function performs a library search for the file name entered. If it finds the file and its directory in the library search path, it strips the path and returns only the file name. (It does not strip the path name if it finds that a file of the same name is in a different directory.) *
16	If this bit is not set, the function returns the entire file name, including the path name. If it's set it will only return the file name and extension. *
32	If this bit is set and bit 0 is set (indicating that a new file is being specified), users will not be warned if they are about to overwrite an existing file. The alert box to warn users that a file of the same name already exists will not be displayed; the old file will just be replaced. *
64	Do not transfer the remote file if the user specifies a URL. *
128	Do not allow URLs at all. *

*Not implemented

Functions in this box may be replaced by other functions names like

CAD-GETANGLE, CAD-GETDIST, CAD-GETPOINT, CAD-GETCORNER and so on...

(GETANGLE <prompt> [basepoint])

(GETDIST <prompt> [basepoint])

(GETINT <prompt> <default> [min] [max])

(GETPOINT [base point] <prompt> <object>)

If the base point argument is used, then you can use the object argument. This will drag the object on the screen when you pick the point.

(GETREAL <Prompt> <default> <min><max>)
This function shows a dialog that ask for a numerical value.

(GETSTRING <Prompt> <default>)

(GETVAR <name>)
This function returns the system variable from IGEMS environment. The <name> must be a valid variable string. Following variables are available:

(GETVAR "DIGFILE") returns the current drawing file name. If the name refers to an existing file then the complete path and extension are returned.
(GETVAR "FILEIMPORT") This function will return the filename of the latest imported file using Copy/Paste, Drag/Drop or the Import command. (Only filename not path)
(GETVAR "LANGUAGE") returns the ISO639-1 two letter code for the language. Example: "se" for English or "se" for Swedish.
(GETVAR "PATHDATA") returns the IGEMS data folder.
(GETVAR "PATHIMPORT") returns the path to the latest imported file using Copy/Paste, Drag/Drop or the Import command.
(GETVAR "PATHSHARED") returns the shared folder location.
(GETVAR "PATHBIN") returns IGEMS bin folder.
(GETVAR "PATHROOT") returns IGEMS installation folder.
(GETVAR "PATHSCRIPT") returns the location of the latest loaded LISP file
(GETVAR "PATHTEMP") returns windows temp directory
(GETVAR "VIEWAREA") returns a list of the currently visible rectangle in the current drawing (x1 y1 x2 y2)
(GETVAR "UNITS") returns actual dimension units 0 for metric and 1 for imperial
(GETVAR "USERNAME") returns the current windows user.

Example:
(GETVAR "PATHDATA") returns "C:/ProgramData/IGEMS Software/IGEMS/10.0.0.0/"

(GUID)
The function returns a unique windows string. The string can be used as a randomly ID.

(GUID) can returns "eb21bb57-9a51-40f4-b0e3-a99d004eaae5"
(GUID) can returns "a41cd4d2-2423-473d-bf7b-edd49dba2ad9"

(IF <testexpr> <thenexpr> [<elseexpr>])

This function conditionally evaluates expressions. If <testexpr> is not nil, then it evaluates <thenexpr> otherwise it evaluates <elseexpr>. The last expression <elseexpr> is optional. IF returns the value of the selected expression. If <elseexpr> is missing and <thenexpr> is nil then IF returns nil.

(IF (= T nil) "Same" "Not same") returns "Not same"
(IF (= (+ 10 20) 30) "Same" "Not same") returns "Same"
(IF (< 22 12) "OK") returns nil

(INTERS <line1start> <line1end> <line2start> <line2end> [infinity])

The function returns the intersection point between line1 and line2. If the optional argument [infinity] is nil or omitted then the intersection point must be on both of the lines else the function will returns nil. If the [infinity] argument is T then the function will always return the intersection point. (Not if the lines are parallel).

(INTERS p1 p2 p3 p4 T) returns a point (z y)

(ITOA <number>)

The function returns the conversion of an integer or a real value to a string. If the value is a real it will be rounded by standard rules.

(ITOA 99) returns "99"
(ITOA 0) returns "0"
(ITOA -6622) returns "-6622"
(ITOA 6.5) returns "7"
(ITOA 6.4) returns "6"

(KDTREE-CREATE <list of points>)

The function create a kdtree object from a list of points. The points has to have Y and Y first but can contain any data after this. The function return the kdtree object.

```
(SETQ p1 (LIST 10 10 "A") p2 (LIST 100 100 "B") p3 (LIST 110 110 "C"))
(SETQ kd (KDTREE-CREATE (LIST p1 p2 p3)))  ;returns the object
```

(KDTREE-FINDCLOSEST <kd> <point> <size> [number of points])

Scans the kd tree for the closest point in the rectangle centered at the <point> with half-width size. Returns the list as specified in KDTREE-CREATE, or nil if no points are in the specified rectangle.

```
(SETQ point (LIST 100 100))
(SETQ ptlist (KDTREE-FINDCLOSEST kd point 20 2))    ;returns ((100 100 "B") (110 110 "C"))
```

(KDTREE-INSERT <kd> <point>)

Insert a new point in an existing KDTREE. The <kd> is the object of an existing KDTREE. The function returns the <kd> object.

```
(SETQ new (LIST 123.456 -118 "The new point"))
(SETQ kd (KDTREE-INSERT kd new))    returns the object
```

(LAMBDA <arguments> <expr> ...)

LAMBDA defines an "anonymous" function. This is typically used when the overhead of defining a new function is not justified. It also makes the programmer's intention more apparent by laying out the function at the spot where it is to be used. LAMBDA returns the value of its last <expr>, and is often used in conjunction with APPLY and/or MAPCAR to perform a function on a list.

(APPLY '(LAMBDA (x y z) (* x (- y z))) (LIST 5 20 14)) returns 30
(SETQ q 0)
(MAPCAR '(LAMBDA (x) (SETQ q (1+ q)) (* x 5)) (LIST 2 4 -6 10.2)) returns
(10 20 -30 51.0)

(LAST <list>)

This function returns the last element in the <list>.

(LAST '(a b c d e f)) returns f
(LAST '(a b c (d e)) returns (d e)
(LAST nil) returns nil

(LENGTH <list>)

This function returns an integer indicating the number of elements in <list>.

(LENGTH '(a b 12 17)) returns 4
(LENGTH (LIST a b)) returns 2
(LENGTH nil) returns 0

(LIST <expr> ...)

This function takes any number of expressions <expr> and put them together, returning a list.

(SETQ a 100 b 200)
(LIST 'a 'b 12 9) returns (A B 12 9)
(LIST a b 12 9) returns (100 200 12 9)

(LISTP <item>)

This function returns T if <items> is a list, and nil otherwise.

(LISTP '(a b c)) returns T
(LISTP 'a) returns nil
(LISTP nil) returns T (nil is an empty list)

(LOAD <filename> [<onfailure>])

This function loads a file of LISP expressions and evaluates those expressions. <filename> is a string that represents the filename without extension (an extension of ".lsp" is assumed). <filename> may include a directory prefix, as in "/function/test".)
If the operation is successful, LOAD returns the value of the last expression in the file. If the LOAD operation fails, it normally causes an LISP error. However, if the <onfailure> argument is supplied, LOAD returns the value of this argument upon failure instead of giving an error. This allows an LISP application calling LOAD to take alternative action upon failure.
Assume that the file "TEST.LSP" does not exist, then

(LOAD "C:/IGEMS_R10/LSP/TEST.LSP") causes a LISP error
(LOAD "C:/IGEMS_R10/LSP/TEST.LSP" "No such file") returns "No such file"

If the same file exist.

(LOAD "C:/IGEMS_R10/LSP/TEST.LSP") returns last evaluation

The LOAD function can be used from within another LISP function, or even recursively (in the file being loaded).

Note: The function GETVAR is useful to get the address of different IGEMS folders.

(LOG <number>)

This function returns the natural log of <number> as a real.

(LOG 4.5) returns 1.50408
(LOG 1.22) returns 0.198851

(LOGAND <number> <number> ...)

This function returns the result of a logical bitwise AND of a list of <number>. The <numbers> must be integers and the result is also an integer.

(LOGAND 4 6) returns 4
(LOGAND 4 1) returns 0
(LOGAND 2 3 15) returns 2
(LOGAND 8 3 4) returns 0

(LOGAND 7 15 3) returns 3

1 (bit1)	2 (bit 2)	4 (bit 3)	8 (bit 4)	16 (bit 5)	32 (bit 6)	
1	**2**	4				= 7
1	**2**	4	8			= 15
1	**2**					= 3

Value 3 (bit 1 and 2) is common for all numbers in the list.

(LOGIOR <number> <number> ...)

This function returns the result of a logical bitwise inclusive OR of a list of <numbers>. The <numbers> must be integers, and the result is also an integer.

(LOGIOR 1 2 4) returns 3
(LOGIOR 9 3) returns 11

(LSH <num> <numbits>)

This function returns the logical bitwise shift of <num> by <numbits>. <num> and <numbits> must be integers, and the result is also an integer. If <numbits> is positive, <num> is shifted to the left, if negative, to the right. In either case, "zero" bits are shifted in, and the bits shifted out are discarded. If a "one" bit is shifted into or out of the top bit of an integer, its sign changes.

(LSH 2 1) returns 4
(LSH 2 -1) returns 1
(LSH 9 1) returns 18
(LSH 9 -1) returns 4

(MAPCAR <function> <list1> ... <listn>)

MAPCAR returns the result of executing <function> with the individual elements of <list1> through <listn> supplied as arguments to <function>. The number of <list>s must match the number of arguments required by <function>. The MAPCAR always return a list of the result.

(SETQ a 10 b 20 c 30)
(MAPCAR '1+ (LIST a b c)) returns (11 21 31)

(MAX <number> <number> ...)

This function returns the largest of the <number>s given. Each <number> may be a real or an integer.

```
(MAX 20 -12 77.1)          returns 77.18
(MAX -12 -10 -3)           returns -3
```

(MEMBER <expr> <list>)

This function searches <list> for an occurrence of <expr> and returns the remainder of <list> starting with the first occurrence of <expr>. If there is no occurrence of <exp> in <list>, MEMBER returns nil.

```
(MEMBER 'c '(a b c d e f))          returns (C D E F)
(MEMBER 10 (LIST 9 10 11 12))       returns (10 11 12)
(MEMBER 10 (LIST 20 30 40))         returns nil
```

(MIN <number> <number> ...)

This function returns the smallest of the <number>s given. Each <number> may be a real or an integer.

```
(MIN 100 200 300)          returns 100
(MIN -100 100)             returns -100
```

(MINUSP <item>)

This function returns T if <item> is a real or integer and evaluates to a negative value, otherwise it returns nil

```
(MINUSP -1)                returns T
(MINUSP 0.0)               returns nil
(MINUSP (- 10 12))         returns T
```

(NOT <item>)

This function returns T if the expression is nil, and nil otherwise.

```
(NOT T)                    returns nil
(NOT nil)                  returns T
(NOT 1)                    returns nil
```

(NTH <number> <list>)

This function returns the <number> element of <list>, where <number> is the number of the element to return (zero is the first element). If <number> is greater than <list>s highest element number, nil is returned.

```
(NTH 0 '(a b c d))         returns A
(NTH 3 '(a b c d))         returns D
(NTH 3 '(10 20))           returns nil
```

(NULL <item>)

This function returns T if <item> is bound to nil, and nil otherwise. For example, given the following assignments:

```
(SETQ a "Text")
(SETQ b nil)
(SETQ c 100)
(NULL a)                   returns nil
(NULL b)                   returns T
(NULL c)
```

(NUMBERP <item>)

This function returns T if <item> is a real or an integer.

(NUMBERP "12") returns nil
(NUMBERP 10) returns T
(NUMBERP -2) returns T
(NUMBERP nil) returns nil

(OPEN <filename> <mode> [encoding])

This function opens a file for access by LISP's I/O functions. It returns a file descriptor to be used by the other I/O functions <filename> is a string specifying the name and may include a directory prefix and a drive letter. You can use the backslash instead of the forward slash (but you must use double "\\" to obtain one backslash in a string.)

(SETQ fw (OPEN "c:/test/test.txt" "w"))

<mode> is the read/write flag. It must be a string containing a single lower case letter. The valid mode letters are described in the following table.

"r" Open for reading. If <filename> does not exist, nil is returned.

"w" Open for writing. If <filename> does not exist, a new file is created and opened. If <filename> already exists, its existing data will be overwritten.

"a" Open for appending. If <filename> does not exist, a new file is created and opened. If <filename> already exists, it is opened and positioned at the end of the existing data, so any new data you write in the file will be appended to the existing data.

Assuming that the files named in the following examples do not exist

(SETQ fr (OPEN "new.txt" "r")) returns nil
(SETQ fw (OPEN "new.txt" "w")) returns FILE
(SETQ fa (OPEN "new.txt" "a")) returns FILE

<encoding>

If encoding is left out or nil, the file is written in the current windows ANSI codepage.

If encoding is T, the file is written in utf-8 encoding, which should be used if an ILISP code file is written.

If encoding is a string, it's the webname of the encoding used, for example "utf-8" "utf-16" "utf-32" and many more. When creating CNC-files you can left out the encoding argument.

(OR <expr> ...)

This function returns the logical OR of a list of expressions. OR evaluates the expressions from left to right, looking for a non-nil expression. If one is found, OR ceases further evaluation and returns T. If all of the expressions are nil, OR returns nil.

(OR nil nil) returns nil
(OR T nil) returns T
(OR "Text" 12) returns T
(OR (= 1 1) (< 1 0)) returns T

Or is often use together with IF or COND functions.

PI

This is not a function, but rather the constant. It evaluates to approximately 3.1415926.

(PING <ip-string> <timeout>)

Checks if a remote connection is available.

<ip string> should be the address of remote computer, for example "192.168.5.110".

The <timeout> argument should be an integer for the timeout in milliseconds before failure (nil) is returned. The function returns T if the remote is responding otherwise nil.

(POLAR <point> <angle> <distance>)

This function returns a point in the <angle> and <distance> from the <point>. The <angle> is expressed in radians from the X axis, with angles increasing in the counterclockwise direction.

```
(SETQ from (LIST 0 0))
(SETQ ang (* PI 0.5))
(SETQ dist 100)
(POLAR from ang dist)                returns (0 100)
(POLAR from (* ang 0.5) dist)        returns (70.7107 70.7107)
```

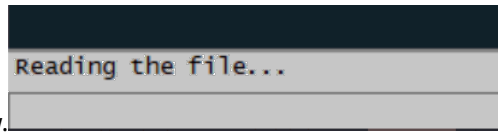
For more information see the Geometrical example.

(PRIN <text>)

This function print the text on the command line area.

```
(PRIN "Reading the file")
```

The function will return the text and write the text in the area you see below.



(PRINC <expr> [<file descriptor>]

This function prints the <expr> on the console or on the file. <expr> can be a string containing control characters.

```
\e          for escape
\n          for newline
\r          for return
\t          for tab
\nnn for the character whose octal code is nnn.
```

```
(PRINC "Part1\tPart2")          will print "Part1   Part2" and return "Part1\tPart2"
```

(PRINT <expr> [<file descriptor>])

This function prints the <expr> on the console or on the file. <expr> can be a string containing control characters. The control characters will be printed out with a leading "\".

(PRINT "Part1\tPart2") will print "Part1\tPart2" and return "Part1\tPart2"

(PROGN <expr> ...)

This function evaluates each <expr> sequentially, and returns the value of the last expression. You can use PROGN to evaluate several expressions where only one expression is expected.

```
(IF (= a b)
 (PROGN
  (SETQ a (+ a 1.5))
  (SETQ b (- b 1.5))
 )
)
```

The IF function normally evaluates one expression. In this example, we have used PROGN to evaluate multiple expressions.

(QUIT <msg>)

This function write the <msg> on the consol and interrupt the lisp execution.

```
(QUIT "*Cancel*")                    returns "*Cancel*"
```

(QUOTE <expr>)

Returns <expr> unevaluated. This can also be written 'expr.

```
(SETQ a 100)
(QUOTE a)                            returns A
```

(RADTODEG <radian>)

This function convert the angle <radian> to degree. See also the function DEGTORAD

(RAND)

The function returns a random value between 0 to 1.

```
(RAND)                               returns 0.15806
(RAND)                               returns 0.7271
```

(READ <string>)

This function can convert a text to a lisp execution.
The function returns the first list or atom obtained from <string>. <string> must not contain blanks.

```
(SETQ txt "(SETQ a 100"))
(READ txt)                           returns (SETQ a 100)
(EVAL (READ txt))                    returns 100
```

(READ-CHAR [<file-desc>])

This function reads a single character from the keyboard input buffer or from the open file described by <file-desc>. It returns the (integer) ASCII code representing the character read.
If no <file-desc> is specified and there are no characters in the keyboard input buffer, READ-CHAR waits for you to type something at the keyboard (followed by RETURN). For instance, assuming that the keyboard input buffer is empty:

```
(SETQ tk (READ-CHAR))
```

will wait for something to be entered. If you type "ABC" followed by RETURN. READ-CHAR will return 65 (the unicode code for the letter "A"). The next three calls to READ-CHAR will return 66, 67. and I 0 (newline). respectively. If another READ-CHAR call is then made, it will again wait for input.

(READ-LINE [<file-desc>])

This function reads a string from the keyboard or from the open file described by <file-desc>. If the end of the file is encountered, READ-LINE returns nil, otherwise it returns the string that was read.

```
(SETQ fr (OPEN "c:/test/test.txt" "r")
(WHILE
  (SETQ txt (READ-LINE fr))
  (PRINC txt)
)
(CLOSE fr)
```

The example above will open a file, read and print out all lines, when it come to the end of the file it will close the file.

(REM <num1> <num2> ...)

This function divides <num1> by <num2> and returns the remainder <num1> mod <num2>. REM may be used with reals or integers.

```
(REM 19 6)          returns 1
(REM 3 2)           returns 1
(REM 2 2)           returns 0
(REM 100 2.2)       returns 1.0
```

(REPEAT <number> <expr> ...)

The function evaluates each <expr> <number> times and returns the value of the last expression. The <number> must be an integer.

```
(SETQ b 1)
(REPEAT 8
  (SETQ b (* b 2))
)
(EVAL b)            returns 256
```

(REVERSE <list>)

The function return the list with its elements reversed.
From version 2016.3.1060 the function can be used also on strings

```
(REVERSE (LIST 1 2 3 4))        returns (4 3 2 1)
(REVERSE '((a b) c d)))         returns (D C (A B))
(REVERSE nil)                   returns nil (nil is an empty list)
(REVERSE "Text")                return "txeT")
```

(ROUND <number>)

The function round the value up or down to the closest value.
See also the functions CEIL and FLOR.

```
(ROUND 0.1)             returns 0.0
(ROUND 1.49999999999)   returns 1.0
(ROUND 1.5)             returns 2.0
(ROUND -100.9)          returns -101.0
```

See also the functions CEIL and FLOR

(RTOS <number> <precision> [<all>])

This function converts a number to a string, the <precision> controls the number of digits. If the <all> argument is nil or not included then ending zeroes will be removed.

```
(RTOS 10 3)             returns "10"
(RTOS 10 3 T)           returns "10.000"
(RTOS 12.5 0)           returns "13"
(RTOS 12.4 0)           returns "12"
(RTOS 0 8 T)            returns "0.00000000"
```

(SET <'a> <value>)

The set function is similar to SETQ except that set evaluates both of its arguments.

```
(SETQ index 0)
(REPEAT 10
  (SET (READ (STRCAT "VAR" (ITOA index))) (* index 10))
```

```
)
(PRINC var5)                    returns 50
(PRINC var7)                    returns 70
```

See also the EVAL function

(SETQ <sym1> <expr1> [<sym2> <expr2>] ...)

This function sets the value of <sym1> to <expr1>, <sym2> to <expr2>, and so on. This is the basic assignment function in LISP. It returns the last <expr>.

```
(SETQ a 5.0)                    returns 5.0
(SETQ b 100 c 32 d "Text")
```

Note! You should never use <symbol names> that are the same as the LISP functions.

(SIN <angle>)

This function returns the sin of <angle> as a real, where <angle> is expressed in radians.

```
(SIN 1.0)                       returns 0.841471
(SIN 0.5)                       returns 0.479426
(SIN 0)                         returns 0.0
```

For more information see the Geometrical example.

(SLEEP <milliseconds>)

The function make a sleep in that time given by the argument.

(SQRT <number>)

This function returns the square root of <number> as a real. The <number> must be positive.

```
(SQRT 4)                        returns 2.0
(SQRT 16)                       returns 4.0
(SQRT 2)                        returns 1.41421
```

For more information see the Geometrical example.

(STARTAPP <appcmd> [<file> <show>])

The command start another windows application. If <appcmd> does not include a full path name, startapp searches the directories in the PATH environment variable for the application. An optional string <file> specifies the file name to be opened. If the show argument evaluates to T then the batfile will be shown in a window else not.

```
(STARTAPP "notepad" "c:/ncdata/test.txt")
```

(STRCASE <string> <lower>)

STRCASE takes the string specified by the <string> argument and returns a copy with all alphabetic characters converted to upper or lower case, depending on the second argument. <lower>. If <lower> is omitted or evaluates to nil, all alphabetic characters in <string> will be converted to upper case. If <lower> is supplied and is not nil, all alphabetic characters in <string> will be converted to lower case.

```
(STRCASE "SAmpLE")              returns "SAMPLE"
(STRCASE "SAmpLE" nil)          returns "SAMPLE"
(STRCASE "SAmpLE" T)            returns "sample"
(STRCASE "SAmpLE" (NUMBERP 1))  returns "sample"
```

(STRCAT <string1> <strinq2>...)

This function returns a string that is the summary of all <strings>.

```
(STRCAT "A" "B" "C" "D")          returns "ABCD"
(STRCAT "IGEMS_R" (ITOA 10))      returns "IGEMS_R10"
(STRCAT "A" "" "B")               returns "AB"
```

(STRFIND <find> <in string>)

The function search for the string <find> in the string <in string> and returns the number of characters before the <find> string as an integer. If the string <find> not exists, then the function returns nil.

```
(STRFIND "" "")                   returns 0
(STRFIND "" "any string")         returns nil
(STRFIND " " "lisp is good")      returns 4
(STRFIND "cde" "abcdef")          returns 2
(STRFIND "cde" "igems")           returns nil
```

(STRLEN <string>)

This function returns the length, in characters, of string <string> as an integer.

```
(STRLEN "CAD/CAM")        returns 7
(STRLEN "")               returns 0
(STRLEN "AB")             returns 2
```

(STRREPLACE <text> <replace> <with>)

This function replace all text specified by <replace> with the text specified by the <with> argument in <text>. All argument must be strings.

```
(STRREPLACE "ABABIGEMSABAB" "AB" "")     returns "IGEMS"
(STRREPLACE "12,5;14,4" "," ".")         returns "12.5;14.4"
```

(STRSUB <text> <start> [<end>])

Note! The normal standard LISP has a function called SUBSTR this is different from this function.

The function returns a substring of the text, starting at the start position of the string and end at the end position of the text. If the end argument is not specified then the substring continues to the end of text. If the end value is smaller than the start value then the function returns an empty substring. If the start or end value are negative, the counter starts from the end of the text instead of the start of the text.

Example:

```
(STRSUB "ABCDEF" 3)               returns "CDEF"
(STRSUB "ABCDEF" 2 2)             returns "B"
(STRSUB "ABCDEF" 3 5)             returns "CDE"
(STRSUB "ABCDEF" -5)              returns "BCDEF"
(STRSUB "ABCDEF" -6 5)            returns "ABCDE"
(STRSUB "ABCDEF" 2 -2)            returns "BCDE"
(STRSUB "ABCDEF" -5 -1)           returns "BCDEF"
(STRSUB "ABCDEF" 10)              returns ""
(STRSUB "ABCDEF" -10)             returns "ABCDEF"
```

(STRTRIM text [<leading> [<ending>]])

This function removes leading or ending whitespaces in a string. The <leading> and <ending> argument is by default set to all whitespaces. This means ASCII 9, 10, 13 and 32. If you don't want to remove <leading> or <ending> the set the argument to ""

```
(STRTRIM "   IGEMS   ")                                    returns "IGEMS"
(SETQ default (STRCAT (CHR 9) (CHR 10) (CHR 13) (CHR 32))
(STRTRIM "   IGEMS   " default "")          returns "IGEMS   "
(STRTRIM "   IGEMS   " "" default)          returns "   IGEMS"
```

(SUBST <new> <old> <list>)

This function searches <list> for <old>, and returns a copy of <list> with <new> replaced in every occurrence of <old>. If <old> is not found in <list>, SUBST returns <list> unchanged.

```
(SUBST new 20 (LIST 20 21 22))                    returns (nil 21 22)
(SUBST 'new 20 (LIST 20 21 22))                   returns (NEW 21 22)
(SUBST (LIST 10 20) 20 (LIST 10 20 30 40))      returns (10 (10 20) 30 40)
(SETQ a nil b nil c nil)
(SUBST T nil (LIST a b c))                                          returns (T T T)
```

(SUBSTR <string> <start> [<length>])

Note! See also the ILISP STRSUB function.

This function returns a substring of <string>, starting at the <start> character position of <string> and continuing for <length> characters. If <length> is not specified, the substring continues to the end of <string>. <start> (and <length>, if present) must be positive integers. The first character of <string> is character number 1.

```
(SUBSTR "abcdef" 1)          returns "abcdedf"
(SUBSTR "abcdef" 4)          returns "def"
(SUBSTR "ABC" 1 1)           returns "A"
(SUBSTR "abcdef" 2 2)        returns "bc"
```

(TCPIP-SEND <send string> <ip string> <port>)

This function sends a string using the TCP-IP protocol to a given address and port.

(TAN <radian>)

The function returns the tangent of an angle in radians.

```
(TAN 0.38044)                returns 40.0
```

For more information see the Geometrical example.

(TIME)

The function returns a list with hours minutes and seconds.

```
(TIME)                       returns (23 45 10)
```

See also the date function.

(TIMENOW)

Returns a time object of actual time

(TIMESPAN <end time> <start time>)

Returns an integer of the time between the two times as milliseconds

(TOSTR <item>)

Convert the item to a string

(TOSTR (LIST "ILISP" (LIST 1 2 3))) returns "(\"ILISP\" (1 2 3))"

(TYPE <item>)

The function returns the type of <item> as a string where type is one of following.

(TYPE 12.2) returns "REAL"
(TYPE (OPEN "test.txt" "r")) returns "FILE"
(TYPE "text") returns "STR"
(TYPE 66) returns "INT"
(TYPE 'SETQ) returns "SYM"
(TYPE (LIST 1 2)) returns "LIST"
(TYPE SETQ) returns "SUBR"

(VER)

Returns the ILISP version as a text string.

(VER) returns "ILISP 1.0"

(WINBREATH)

This function can be used when having long processing times to avoid windows to leave the message. Windows not responding. The function should be called for example every 10 second.

(WHILE <testexpr> <expr> ...)

This function evaluates <testexpr> and if not nil then evaluate <expr> . This continues until <testexpr> is nil

```
(SETQ q 0)
(WHILE (< q 10)
  (PRINC (ITOA (SETQ q (1+ q))))
)
```

This will print 1 2 3 4 5 6 7 8 9 10 on the consol and return "10"

(WRITE-CHAR <num> [<file-desc>])

This function writes one character to the console or to the open file described by <file-desc> <num> is the Unicode for the character to be written, and is also the value returned by the function.

(WRITE-CHAR 333) write the character "ö" and returns 319
(WRITE-CHAR 65) write the character "A" and returns 65

(WRITE-LINE <string> [<file-desc>])

This function writes <string> to the screen or to the open file described by <file-desc>. It returns <string> quoted in the normal manner, but omits the quotes when writing to the file. For example, assuming that fw is a valid open file descriptor:

```
(SETQ fw (OPEN "c:/test/test.txt" "w")
(WRITE-LINE "First line" fw)
(WRITE-LINE "Last line" fw)
(CLOSE fw)
```

(ZEROP <item>)

This function returns T if <item> is a real or integer and evaluates to zero, otherwise it returns nil. It is not defined for other <item> types.

```
(ZEROP -1)                    returns nil
(ZEROP 1)                     returns nil
(ZEROP 0.0)                   returns T
(ZEROP (- (* 10 10) 100))     returns T
```

(POINTSORT <pointlist> <method>)

This function sorts a list of points. The two first arguments in each point-list is the X and Y coordinates. The function can sort in following methods:

-1=The shortest of all methods 0-8.

0=Left to tight.

1=Right to Left.

2=Bottom to top.

3=Top to bottom.

4=Closest from first point.

5=Zig zag start Lower left.

6=ZigZag Start Lower Right.

7=ZigZag Start Upper Left.

8=ZigZag Start Upper right.

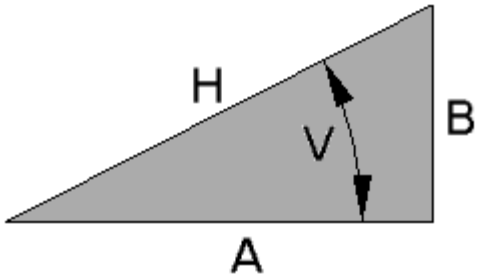
```
(SETQ pointlist '((10.0 2.0 "text1" 100) (5.0 5.9 "text2" 90))
(SETQ sorted (POINTSORT pointlist 1))   returns ((5.0 5.9 "text2" 90) (10.0 2.0 "text1" 100))
```

Geometrical example

This chapter describes more in deep some functionality.

Geometrical examples

This chapter gives more examples on geometrical functions.

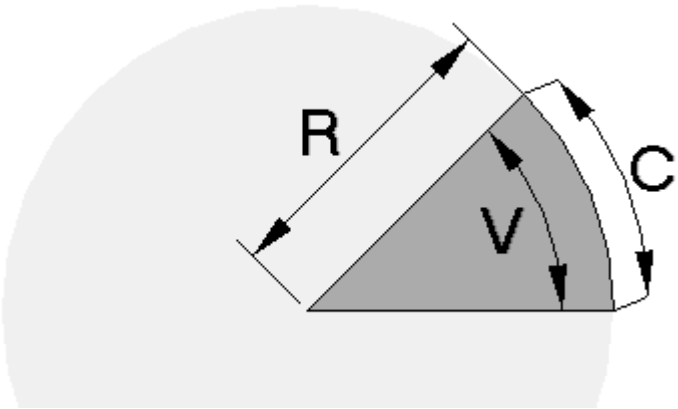


All angles must are in radians and will be returns in radians.

P1 and P2 are lists with X and Y coordinates.

Examples:

(* (SIN V) H)	returns B
(* (COS V) H)	returns A
(* (TAN V) A)	returns B
(ASIN (/ B H))	returns V
(ACOS (/ A H))	returns V
(ATAN B A)	returns V
(ATAN (/ B A))	returns V
(/ B (SIN V))	returns H
(/ A (COS V))	returns H
(/ B (TAN V))	returns A
(SQRT (+ (EXPT A 2)(EXPT B 2)))	returns H
(SQRT (+ (* A A) (* B B)))	returns H
(SQRT (- (* H H) (* A A)))	returns B
(SQRT (- (* H H) (* B B)))	returns A
(POLAR p1 V H)	returns P2
(ANGLE p1 p2)	returns V
(DISTANCE p1 p2)	returns H
(ANGTOS v 3)	returns "DEGREE AS A STRING WITH 3 DECIMALS"



R is the radius, V is the angle and C is the circumference.

(* V R)	returns C
(/ C V)	returns R
(/ C R)	returns V

Convert degree to radians:

(/ (* degree PI) 180.0)	returns radians

Convert radians to degree:

(* (/ 180 PI) radians)	returns degree

Circle calculations:

(* diameter PI)	returns circumference
(/ circumference PI)	returns diameter
(* radie radie PI)	returns area
(SQRT (/ area PI))	returns radie

Toolbar

(TB-HLP cmdid htmlfile [urlpath])

Maps a help file to a command.
If urlpath is not given, the urlpath defaults to:
"http://www.igems.se/helpX.Y/"
Where X is major verison and Y is quarter release number 1 to 4.

Variables

This rules is for IGEMS.LSP and the postprocessor
All variables from the Machine, Method and the material settings. *variable*
All untranced coordinates pp_
All transed coordinates pp_$
All coordinates that should be send to postprocessor $

Exemple of passing variables between functions
If a variable is local it's still global in a function in an upper level.
The VAR is local in Func1.
The Func1 use function CHKVAR.
The Var is also declared local in the VARCHK function but it can be used as it was passed by argument.
If you change the value of VAR in the VARCHK function, this has no effect of the variable in the FUNC1 function

Example:

```
(DEFUN func1 (/ var)
  (SETQ var "A")
  (PRINC "\nFUNC1 var= ")(PRINC var)
  (VARCHK)
  (PRINC "\nFUNC1 var=")(PRINC var)
  (PRINC "\n")
)
```

```
(DEFUN varchk (/ var)
  (PRINC "\nVARCHK var=") (PRINC var)
  (SETQ var nil)
  (PRINC "\nVARCHK var=") (PRINC var)
)
```

The function FUNC1 will print following:

```
FUNC1 var=A
VARCHK var= A
VARCHK var= nil
FUNC1 var=A
```

If the variable is not global in the VARCHK function it will also affect the variable in the FUN1 function.

```
(DEFUN varchk ()
  (PRINC "\nVARCHK var=") (PRINC var)
  (SETQ var nil)
  (PRINC "\nVARCHK var=") (PRINC var)
)
```

The function FUNC1 will print following:

```
FUNC1 var=A
VARCHK var= A
VARCHK var= nil
FUNC1 var=nil
```

Dynamic Dialogs

IGEMS have a possibility to create and handle dialog boxed thru the ILISP programming interface. The dialogs can be used in applications or in postprocessors.

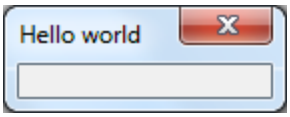
Functions that create the dialog objects

The function below is used to create the dialog lauout.

(GP-DIALOG <caption> [attributes..])

This function creates a dialog with the text <caption> in the title row. The function returns a pointer that should be used as parent to all other objects that are included in the dialog box. The function returns the object name of the control.
The attribute MAXBUTTON and MINBUTTON controls if this button should be shown at the upper right corner of the dialog.
Following attributes can be used.
ACTION CAPTION CHILDALIGN CHILDEXPANDX CHILDEXPANDY CHILDUNIFORMH CHILDUNIFORMW HEIGHT RESIZABLE VERTICAL WIDTH WRAPCOUNT VISIBLE MAXBUTTON MINBUTTON

Example: 1

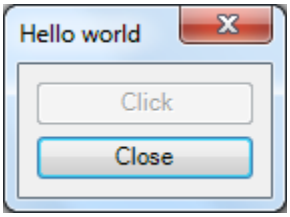



```
(SETQ dlg (GP-DIALOG "Hello world"))
(GP-SHOWMODAL dlg)
```

(GP-BUTTON <parent> <caption> [attributes..])

The function creates a button in parent dialog with the text <caption>. The function returns the object name of the control.
Following attributes can be used:
ACTION ALIGN CAPTION DEFAULT ENABLED EXPANDX EXPANDY FLAT HEIGHT IMAGE RESPONSE UNIFORMH UNIFORMW WIDTH VALUE VISIBLE
The value attribute is read only and can be used for mouse down

Example: 2



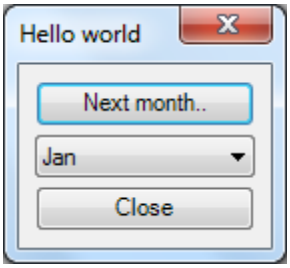

```
(SETQ dlg (GP-DIALOG "Hello world"))
(SETQ button1 (GP-BUTTON dlg "Click" ENABLED nil))
(SETQ button2 (GP-BUTTON dlg "Close"))
(GP-SHOWMODAL dlg)
```

The VALUE attribute is read only and can be used to check Mouse down. As long as the button is down then the VALUE is T else nil.

(GP-CHOICE <parent> <list> [attributes..])

This function creates a drop-down list in the parent object. The list should be a list of strings or empty. The function returns the object name of the control. Default width is set to 75.
Following attributes can be used:
ACTION ALIGN ENABLED EXPANDX EXPANDY HEIGHT UNIFORMH UNIFORMW VALUE WIDTH VISIBLE

Example: 3




```
(SETQ dlg (GP-DIALOG "Hello world"))
(SETQ button1 (GP-BUTTON dlg "Click"))
(SETQ choice (GP-CHOICE dlg (LIST "Jan" "Feb" "March" "April")))
(GP-SHOWMODAL dlg)
```

Next example shows how the controllers can be interacted.

Example 2:

```
; Initialize needed variables
(SETQ month (LIST "Jan" "Feb" "March" "April" "May" "June" "July" "Aug" "Sept" "Oct" "Now" "Dec"))
(SETQ showmonth 0)
; Initialize needed function
(DEFUN handler (object) ; Called each time an object is changed
 (COND
  ((= object button)
   (SETQ showmonth (1+ showmonth))
   (IF (>= showmonth (LENGTH month)) (SETQ showmonth 0))
   (GP-SETQ choice VALUE showmonth))
  ((= object choice)
   (SETQ showmonth (GP-GETQ choice VALUE)))
 )
)
; Create the dialog
(SETQ dlg (GP-DIALOG "Hello world" ACTION handler))
(SETQ button (GP-BUTTON dlg "Next month.."))
(SETQ choice (GP-CHOICE dlg month VALUE showmonth))
(SETQ b:close (GP-BUTTON dlg "Close" RESPONSE ""))
(GP-SHOWMODAL dlg)
```

(GP-EDIT <parent> [attributes..])

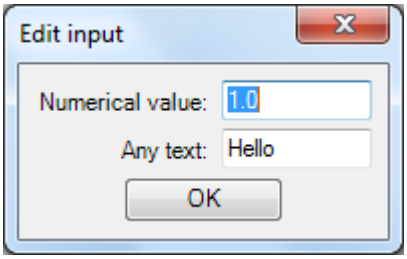
This function creates a text edit area in the parent object. The values that come from GP-EDIT are always a string. If you want a numerical value then you must convert it to a numerical value. The function DISTOF is designed for that. Note that GP-EDIT do not have any CAPTION attribute. If you need a text you must use the GP-LABEL function. The function returns the object name of the control. Default width is set to 75.

Following attributes can be used:

ACTION ALIGN ENABLED EXPANDX EXPANDY HEIGHT UNIFORMH UNIFORMW VALUE WIDTH ENTERSIMTAB VISIBLE

If you set the attribute ENTERSIMTAB to T then Enter can be used as TAB

Example: 4




```
; Initialize needed variables and functions
(SETQ numvalue 100 txtvalue "Hello")
(DEFUN handler (object) ; Called each time an object is changed
 (COND
  ((= object edit1)
   (SETQ numvalue (DISTOF (GP-GETQ object VALUE)))
   (IF (NOT numvalue)
    (PROGN
     (GP-MESSAGE "Message" "Value must be numerical")
     (SETQ numvalue (GP-OLDVALUE))
     (GP-SETQ object VALUE numvalue)
     (GP-FOCUS object T))
    (GP-SETQ object VALUE numvalue)))
  ((= object edit2)
   (SETQ txtvalue (GP-GETQ object VALUE)))
  ((= object button)
   (GP-CLOSE dlg "1"))
 )
)
; Create the dialog
(SETQ dlg (GP-DIALOG "Edit input" ACTION handler))

(SETQ row1 (GP-ROW dlg))
(SETQ label1 (GP-LABEL row1 "Numerical value:"))
(SETQ edit1 (GP-EDIT row1 VALUE numvalue))

(SETQ row2 (GP-ROW dlg ALIGN GPC-RIGHT))
(SETQ label2 (GP-LABEL row2 "Any text:"))
(SETQ edit2 (GP-EDIT row2 VALUE txtvalue))

(SETQ button (GP-BUTTON dlg "OK" EXPANDX nil WIDTH 80 ALIGN GPC-BOTTOM))
(GP-SHOWMODAL dlg)
```

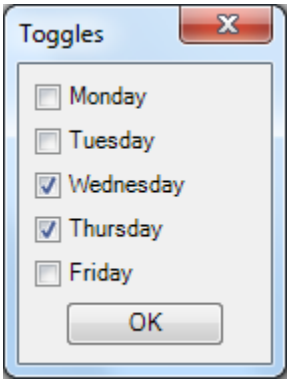
(GP-TOGGLE <parent> <caption> [attributes..])

This function creates a checkbox in parent with the text caption. The checkbox is not checked that must be done with the attribute VALUE that can be T or nil. The function returns the object name of the control.

Following attributes can be used:

ACTION ALIGN CAPTION ENABLED EXPANDX EXPANDY HEIGHT UNIFORMH UNIFORMW VALUE WIDTH VISIBLE

Example: 5




```
; Initialize needed variables and functions
(SETQ daylist (LIST nil nil T T nil))
(DEFUN handler (object) ; Called each time an object is changed
  (SETQ newdaylist (LIST (GP-GETQ t:0 VALUE) (GP-GETQ t:1 VALUE) (GP-GETQ t:2 VALUE)
                 (GP-GETQ t:3 VALUE) (GP-GETQ t:4 VALUE)))
  (PRINC newdaylist)
  (GP-CLOSE dlg newdaylist)
)
; Create the dialog
(SETQ dlg (GP-DIALOG "Toggles"))
(SETQ t:0 (GP-TOGGLE dlg "Monday" VALUE (NTH 0 daylist)))
(SETQ t:1 (GP-TOGGLE dlg "Tuesday" VALUE (NTH 1 daylist)))
(SETQ t:2 (GP-TOGGLE dlg "Wednesday" VALUE (NTH 2 daylist)))
(SETQ t:3 (GP-TOGGLE dlg "Thursday" VALUE (NTH 3 daylist)))
(SETQ t:4 (GP-TOGGLE dlg "Friday" VALUE (NTH 4 daylist)))
(SETQ button (GP-BUTTON dlg "OK" EXPANDX nil WIDTH 80 ALIGN GPC-BOTTOM ACTION handler))
(GP-SHOWMODAL dlg)
```

(GP-TOGGLEBUTTON <parent> <caption> [attributes])

This is a variant of the GP-TOGGLE that works in a similar way as the GP-TOGGLE. The only different is that this object has a design of a button. It has the same attributes and properties.
The IMAGE was added in R2018.3.1670.

(GP-TRACKBAR <parent> <vertical> [attributes])

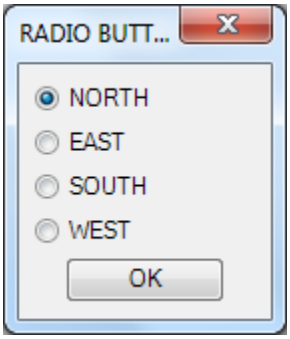
Following attributes can be used:
VALUE, MINVALUE, MAXVALUE, ACTION
Default min and max values is 0 to 1.

(GP-RADIO <parent> <caption> [attributes])

This function creates a radio button with the text <caption>. Only one of the radio buttons that are on the same parent can be activated at the same time. Note that it's not possible to use GP-ROW and GP-COLUMN as parent. If you need GR-RADIO in several groups than you must use GP-FRAME. The function returns the object name of the control.
Following attributes can be used:
ACTION ALIGN CAPTION ENABLED EXPANDX EXPANDY HEIGHT UNIFORMH UNIFORMW VALUE WIDTH VISIBLE BUTTON
When setting the attribute BUTTON to T the GP-RADIO is displayed in a button style-

Example 6

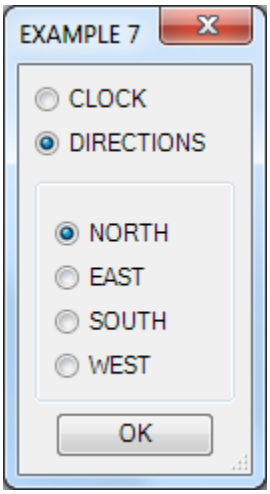
In this example we are using 4 radio buttons




```
; Initialize needed variables and functions
(SETQ direction "NORTH")
(DEFUN handler (object) ; Called each time an object is changed
 (COND
  ((= object button)
   (GP-CLOSE dlg direction))
  (T (SETQ direction (GP-GETQ object CAPTION)))
 )
)
; Create the dialog
(SETQ dlg (GP-DIALOG "RADIO BUTTONS" ACTION handler))
(SETQ r:0 (GP-RADIO dlg "NORTH" VALUE T))
(SETQ r:1 (GP-RADIO dlg "EAST"))
(SETQ r:2 (GP-RADIO dlg "SOUTH"))
(SETQ r:3 (GP-RADIO dlg "WEST"))
(SETQ button (GP-BUTTON dlg "OK" EXPANDX nil WIDTH 80 ALIGN GPC-BOTTOM))
(ALERT (GP-SHOWMODAL dlg))
```

Example 7

In this example we are using two groups of radio buttons, the first group change caption on the second group.




```
; Initialize needed function
(DEFUN handler (object); Called each time an object is changed
 (COND
  ((= object r1:clock)
   (GP-SETQ r2:n CAPTION "00:00")
   (GP-SETQ r2:e CAPTION "03:00")
   (GP-SETQ r2:s CAPTION "06:00")
   (GP-SETQ r2:w CAPTION "09:00"))
  ((= object r1:direction)
   (GP-SETQ r2:n CAPTION "NORTH")
   (GP-SETQ r2:e CAPTION "EAST")
```

```
    (GP-SETQ r2:s CAPTION "SOUTH")
    (GP-SETQ r2:w CAPTION "WEST"))
   ((= object b:ok)
    (GP-CLOSE dlg (GP-GETQ rbused CAPTION))) ; Get caption from last used direction and close
   (T (SETQ rbused object)) ; Save the last used direction
  )
)
; Create the dialog
(SETQ dlg (GP-DIALOG "EXSAMPLE 7" ACTION handler))
(SETQ r1:clock (GP-RADIO dlg "CLOCK"))
(SETQ r1:direction (GP-RADIO dlg "DIRECTINS" VALUE T))
(SETQ frame (GP-FRAME dlg ""))
(SETQ r2:n (GP-RADIO frame "NORTH" VALUE T) rbused r2:n)
(SETQ r2:e (GP-RADIO frame "EAST"))
(SETQ r2:s (GP-RADIO frame "SOUTH"))
(SETQ r2:w (GP-RADIO frame "WEST"))
(SETQ b:ok (GP-BUTTON dlg "OK" EXPANDX nil WIDTH 80 ALIGN GPC-BOTTOM))
(ALERT (GP-SHOWMODAL dlg))
```

(GP-LABEL <parent> <caption> [attributes...])

This function creates a text object. The function returns the object name of the control,

Following attributes can be used:

ACTION ALIGN CAPTION ENABLED EXPANDX EXPANDY HEIGHT UNIFORMH UNIFORMW VALUE WIDTH VISIBLE

(GP-LISTBOX <parent> <lst> [attributes...])

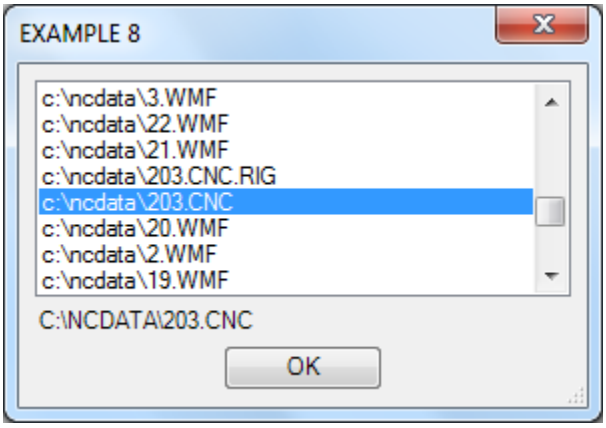
Create a list box. The object in the list box can be defined by the list <lst> or by the function GP-APPEND. The function returns the object name of the control. Default width is set to 75.

Following attributes can be used:

ACTION ALIGN ENABLED EXPANDX EXPANDY HEIGHT UNIFORMH UNIFORMW VALUE WIDTH VISIBLE

Example 8

In this example we will read all files in a directory and add them to the list, when you clock on a file, the file name will be written in a label.




```
; Initialize needed variables and functions
(SETQ filelist (FILE-FINDALL "c:\\ncdata" "*"))
(DEFUN handler (object) ;Called each time an object is changed
 (COND
  ((= object l:files)
   (SETQ findex (GP-GETQ l:files VALUE))
   (SETQ filename (NTH findex filelist))
   (GP-SETQ t:file CAPTION (STRCASE filename)))
```

```
   ((= object b:close) (GP-CLOSE dlg T))
  )
)
; Create the dialog
(SETQ dlg (GP-DIALOG "EXAMPLE 8" ACTION handler RESIZABLE T WIDTH 300))
(SETQ l:files (GP-LISTBOX dlg filelist))
(SETQ t:file (GP-LABEL dlg ""))
(SETQ b:close (GP-BUTTON dlg "OK" ALIGN GPC-CENTER EXPANDX nil WIDTH 80))
(GP-SHOWMODAL dlg)
```

(GP-IMAGE <filename>)

This function creates an image object that can be used on GP-BUTTON controls. The file type must be a BMP, JPG or PNG image.

If the image files are located in the same directory as the LSP file, you don't have to include the path. If you should create dialogs for a postprocessor then you must include the path. GP-IMAGE has no available attribute. The function returns the object name of the control.

Example 9


```
; Initialize needed variable and functions
(SETQ imagelist (LIST (GP-IMAGE "fish.png") (GP-IMAGE "duck.png")
                (GP-IMAGE "lion.png") (GP-IMAGE "rabbit.png") (GP-IMAGE "shark.png")))
(SETQ imageindex 0)
(DEFUN handler (object) ; Called each time an object is changed
  (COND
   ((= object b:animal)
    (SETQ imageindex (1+ imageindex))
    (IF (>= imageindex (LENGTH imagelist)) (SETQ imageindex 0))
    (GP-SETQ b:animal IMAGE (NTH imageindex imagelist)))
   ((= object b:close)
    (GP-CLOSE dlg ""))
  )
)
; Create the dialog
(SETQ dlg (GP-DIALOG "EXAMPLE 9" ACTION handler))
(SETQ label (GP-LABEL dlg "Click on animal" ALIGN GPC-CENTER EXPANDX nil))
(SETQ b:animal (GP-BUTTON dlg "" IMAGE (NTH 0 IMAGELIST) FLAT T))
(SETQ b:close (GP-BUTTON dlg "Close"))
(GP-SHOWMODAL dlg)
```

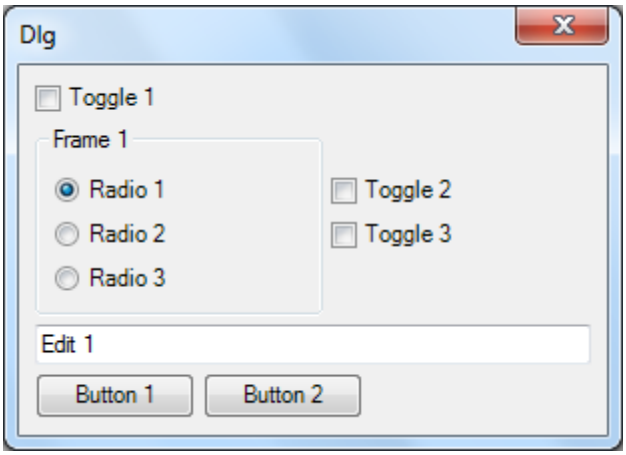
(GP-MEMO <parent> [attributes...])

Creates a multiline edit box.

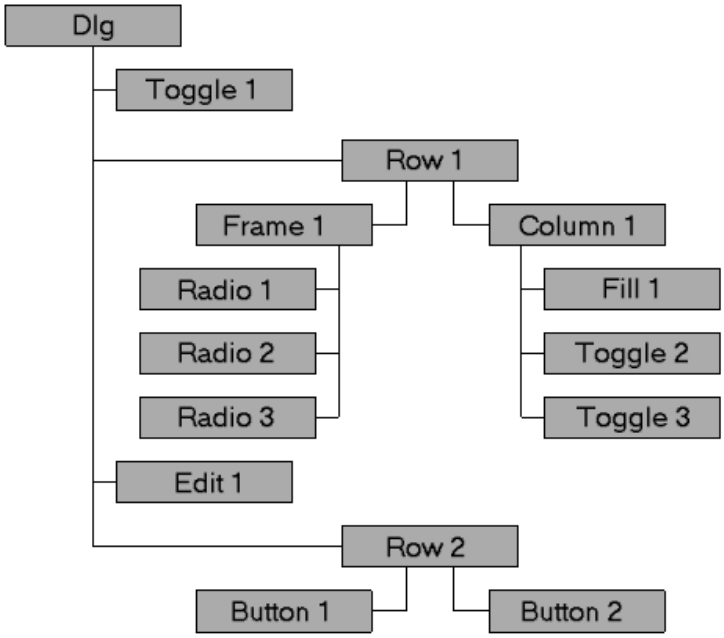
VALUE is the text in the memo box.

Functions that control the layout of the dialog

The dialog contains of the parent dialog and all controllers that are in the dialog. You can more sophisticated dialogs by grouping them in rows and columns as a tree structure.



The figure below shows the structure between the controls, rows and columns.



Example 10

```
(SETQ dlg (GP-DIALOG "Dlg" WIDTH 300))
(SETQ toggle1 (GP-TOGGLE dlg "Toggle 1"))
(SETQ row1 (GP-ROW dlg))
(SETQ frame1 (GP-FRAME row1 "Frame 1"))
(SETQ column1 (GP-COLUMN row1))
(SETQ radio1 (GP-RADIO frame1 "Radio 1" VALUE T))
(SETQ radio2 (GP-RADIO frame1 "Radio 2"))
(SETQ radio3 (GP-RADIO frame1 "Radio 3"))
(SETQ fill1 (GP-FILL column1 HEIGHT 20))
(SETQ toggle2 (GP-TOGGLE column1 "Toggle 2"))
(SETQ toggle3 (GP-TOGGLE column1 "Toggle 3"))
(SETQ edit1 (GP-EDIT dlg VALUE "Edit 1"))
(SETQ row2 (GP-ROW dlg))
(SETQ button1 (GP-BUTTON row2 "Button 1" WIDTH 80))
(SETQ button2 (GP-BUTTON row2 "Button 2" WIDTH 80))
(GP-SHOWMODAL dlg)
```

(GP-ROW <parent> [attributes..])

This function creates a row din the dialog. Available attributes are:

Following attributes can be used:

ALIGN CHILDALIGN CHILDEXPANDX CHILDEXPANDY CHILDUNIFORMH CHILDUNIFORMW ENABLED EXPANDX EXPANDY UNIFORMH UNIFORMW VERTICAL WRAPCOUNT VISIBLE GAP

(GP-COLUMN <parent> [attributes..])

This function creates a row din the dialog. Available attributes are:

Following attributes can be used:

ALIGN CHILDALIGN CHILDEXPANDX CHILDEXPANDY CHILDUNIFORMH CHILDUNIFORMW ENABLED EXPANDX EXPANDY UNIFORMH UNIFORMW VERTICAL WRAPCOUNT VISIBLE GAP

(GP-FRAME <parent> <caption> [attributes])

Create a frame with the text <caption> in the upper left corner. GP-FRAME can be a parent to other controllers.

Following attributes can be used:

ALIGN CAPTION CHILDALIGN CHILDEXPANDX CHILDEXPANDY CHILDUNIFORMH CHILDUNIFORMW ENABLED EXPANDX EXPANDY UNIFORMH UNIFORMW VERTICAL WRAPCOUNT VISIBLE GAP

(GP-FILL <parent> [attributes..])

Following attributes can be used:

ALIGN EXPANDX EXPANDY HEIGHT UNIFORMH UNIFORMW WIDTH VISIBLE

Creates an empty area in the dialog. The function is usable when creating more advance dialogs. You can activate EXPAND to press other controllers in different directions or to set a fixed size by using the HEIGHT and WIDTH attributes.

Following attributes can be used:

ALIGN
EXPANDX
EXPANDY
HEIGHT
UNIFORMH
UNIFORMW
WIDTH

(GP-TABS <parent> [attributes..])

Creates a tab control.

VALUE attribute is an integer, which is an index of the currently selected page. If no page exist then the value is -1. ACTION attribute is used when the user changes tab.

Following attributes can be used:

ALIGN, ENABLED, EXPANDX, EXPANDY, HEIGHT, UNIFORMH, UNIFORMW, WIDTH VISIBLE

(GP-TABPAGE <parent> [attributes ..])

Creates a tab page for a GP-TABS control. Parent has to be a tab control or an error will be raised. The tab page works like a GP-COLUMN but can be altered to work as a grid or just like GP-COLUMN.

Following attributes can be used:

CHILDALIGN CHILDEXPANDX CHILDEXPANDY CHILDUNIFORMH CHILDUNIFORMW VERTICAL WRAPCOUNT VISIBLE

Example:

```
(DEFUN handler (object)
 (COND
  ((= object tabs)
   (SETQ index (GP-GETQ object VALUE))
   (COND
    ((= index 0) (GP-SETQ tablabel CAPTION (STRCAT "Page 1")))
    ((= index 1) (GP-SETQ tablabel CAPTION (STRCAT "Page 2")))))
  ((= object b:close)
   (GP-CLOSE dlg nil))
 )
)
(SETQ dlg (GP-DIALOG "TAB SAMPLE" RESIZABLE T ACTION handler))
(SETQ tablabel (GP-LABEL dlg ""))
(SETQ tabs (GP-TABS dlg))
(SETQ page1 (GP-TABPAGE tabs "FRUITS"))
(SETQ btn1 (GP-BUTTON page1 "Apples"))
(SETQ btn2 (GP-BUTTON page1 "Oranges"))
(SETQ page2 (GP-TABPAGE tabs "VEGETABLES"))
(SETQ btn1 (GP-BUTTON page2 "Carrots"))
(SETQ btn2 (GP-BUTTON page2 "Beetroot"))
(SETQ b:ok (GP-BUTTON dlg "OK" EXPANDX nil WIDTH 80 ALIGN GPC-CENTER))
(GP-SHOWMODAL dlg)
```

Functions that controls the behavior of the dialogs

(GP-SHOWMODAL <dialog>)

The function shows the dialog. The value that the function will return can be specified at different way.

- On a GP-BUTTON with the attribute RESPONSE
- With the GP-CLOSE function.
- If the user press ESC or close the dialog it will return nil unless you don't take care of this in the ACTION callback function.

(GP-CLOSE <dialog> <return value>)

This function is normally used in the ACTION callback function. It will close the dialog. The specified return value will be used by the GP-SHOWMODAL function.

(GP-MESSAGE <title> <caption>)

This function is similar to the ALERT function. The function shows a message box with the <title> and the <caption> value and an OK button.

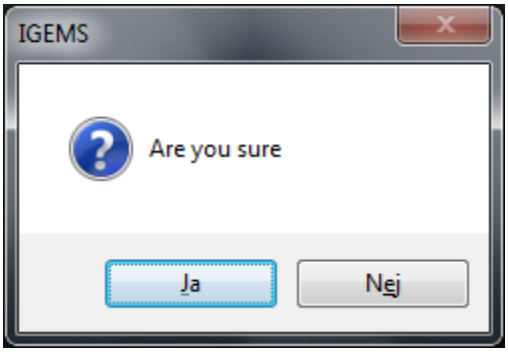
Example:
(GP-MESSAGE "Title" "Caption") returns "Caption"

(The function ALERT that does the same thing will later be removed. Use GP-MESSAGE instead of ALERT)

(GP-YESNO <caption> [default])

This function shows windows standard message box with a Yes and No button. The <default> argument control if "Yes" or "No" should be default. No is nil and yes is non-nil. If the argument is omitted then default is nil.

Example:
(GP-YESNO "Are you sure" T) returns T if user press Yes else nil.



The dialog use the language specified in Windows.

(GP-FOCUS <control> [select])

This function moves the focus to the <control>. The control must be in the active dialog. If the optional argument [select] is T used on a GP-EDIT control then the text is marked.

(GP-SETQ <control> [attributes...])

This function can change attributes like CAPTION and VALUE afterwards in a controller.

(GP-GETQ <control> <attribute>)

This function returns the actual value for an attribute. In the most cases it's used for getting the value for a controller.

(GP-OLDVALUE)

Every time when a control gets focus, then the old value in the control is saved internally. This function returns the old value. Normally the function is used to read the old value on incorrect entries.

(GP-RESTORE)

This function reset the controller to its value it had before it lost focus. The function is normally used together with GP-OLDVALUE. If the controller is a GP-EDIT then the information is selected.

(GP-RGBINT <red> <green> <blue>)

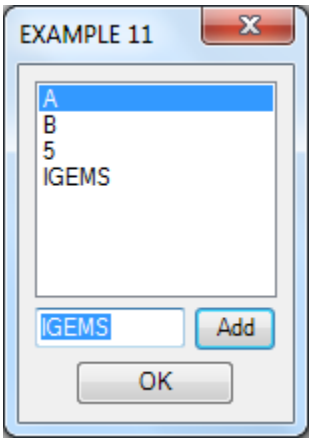
This function takes three arguments with integers from 0 to 255. The function returns a RGB value that can be used for the BGCOLOR and FGCOLOR attributes.

(GP-APPEND <control> <value>)

This function adds a new object in the controller. The control must be a GP-CHOICE or a GP-LISTBOX. The value don't have to be a string, it adds the same text as PRINC should have done.

Example 11

In the example we will add new items in the listbox. The new items are defined in a GP-EDIT and added to the list when you press the Add button. When you press OK then the value is printed out.




```
; Initialize needed variable and functions
(SETQ objlist (LIST "A" "B" (+ 2 3)))
(SETQ index 0)
(DEFUN handler (object / value) ; Called each time an object is changed
 (COND
  ((= object b:add)
   (SETQ value (GP-GETQ e:text VALUE))
   (IF (/= value "")
    (PROGN
     (SETQ objlist (REVERSE (CONS value (REVERSE objlist))))
     (GP-APPEND l:list value)
     (GP-FOCUS e:text T))))
  ((= object b:ok)
   (GP-CLOSE dlg (GP-GETQ l:list VALUE))) ; Return index from the listbox and close
 )
)
; Create the dialog
(SETQ dlg (GP-DIALOG "EXAMPLE 11" ACTION handler))
(SETQ l:list (GP-LISTBOX dlg objlist VALUE index))
(SETQ row1 (GP-ROW dlg))
(SETQ e:text (GP-EDIT row1 VALUE ""))
(SETQ b:add (GP-BUTTON row1 "Add" DEFAULT T))
(SETQ b:ok (GP-BUTTON dlg "OK" EXPANDX nil WIDTH 80 ALIGN GPC-CENTER))
(GP-FOCUS e:text)
(SETQ index (GP-SHOWMODAL dlg))
(PRINC (NTH index objlist))
```

(GP-REMOVE <control> <index>)

This function is the opposite as GP-APPEND. It removes an entry from a list or a combo box. The function return the index.

Attribute for the dialogs

ACTION

With the ACTION attribute you can define a callback function that will be used on interaction with controllers. If you define the ACTION in the GP-DIALOG then the defined function will be used for all controls used on that dialog. You can also define ACTION that will be used locally on other controls)

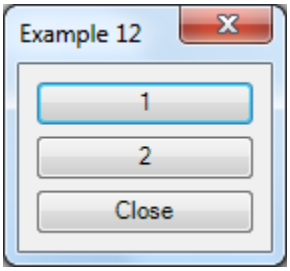
The function defined by ACTION are called when you one of following.

1. You click on a GP-BUTTON.
2. You change selected object in GP-CHOICE or GP-LISTBOX.
3. When you leave GP-EDIT.
4. You click on a GP-LABEL.
5. When you activate or deactivate a GP-TOGGLE.
6. When you activate a GP-RADIO.
7. When you terminate a dialog with ESCAPE or the upper right terminate button in the dialog. In this example the object name is the dialog itself.

The ALIGN attribute can be used on all controls except for GP-DIALOG.

Example 12

This example shows how the ACTION attribute is calling the handler function. It also takes care of ESCAPE.




```
(DEFUN handler (object) ; The callback function defined by ACTION
 (COND
  ((= object button:1)
   (PRINC "1"))
  ((= object button:2)
   (PRINC "2"))
  ((= object b:close)
   (GP-CLOSE dlg "Dialog Closed"))
  ((= object dlg) ; If the object the dialog then this indicate that the user pressed ESCAPE
   (GP-CLOSE dlg "Dialog Terminated"))
 )
)

(SETQ dlg (GP-DIALOG "Example 12" ACTION handler))
(SETQ button:1 (GP-BUTTON dlg "1"))
(SETQ button:2 (GP-BUTTON dlg "2"))
(SETQ b:close (GP-BUTTON dlg "Close"))
(SETQ txt (GP-SHOWMODAL dlg))
(PRINC txt)
```

ALIGN

This attribute determines where the controller should be placed on the dialog. The attribute is only needed if it's free space around the controller and you want to place the controller in special position on that empty area. The ALIGN attribute is an integer that are pre-defined as constants.

Integer	Constant name	Position
0	GPC-CENTER	In the center of the free area.
1	GPC-LEFT	On the left side in the free area.
2	GPC-TOP	On the top of the free area.
4	GPC-RIGHT	On the right side of the free area
8	GPC-BOTTOM	On the bottom of the free area-

It's also possible to combine different meaningful position like 3, 6, 9 and 12.
Note! You can't change the ALIGN attribute after that the dialog has been started by the GP-SHOWMODAL function.

BGCOLOR

Background color. The value assigned to this attribute is an integer created by the GP-RGBINT function. Se also the FGCOLOR attribute.

CAPTION

The CAPTION attribute can be used on following controls:
GP-BUTTON, GP-FRAME, GP-LABEL, GP-DIALOG, GP-TOGGLE and GP-RADIO
The attribute should always be a string and it can be changed at any time, for example in the callback function.

CHILDALIGN

This attribute can be set to T or nil and be used on following controls: GP-DIALOG, GR-FRAME, GP-ROW and GP-COLUMN. The attribute use the same information as ALIGN. It's valid for all children that don't have any ALIGN specified.

CHILDEXPANDX

This attribute can be set to T or nil and be used on following controls: GP-DIALOG, GR-FRAME, GP-ROW and GP-COLUMN. The attribute use the same information as EXPANDX. It's valid for all children that don't have any EXPANDX specified.

CHILDEXPANDY

This attribute can be set to T or nil and be used on following controls: GP-DIALOG, GR-FRAME, GP-ROW and GP-COLUMN. The attribute use the same information as EXPANDY. It's valid for all children that don't have any EXPANDY specified.

CHILDUNIFORMH

This attribute can be set to T or nil and be used on following controls: GP-DIALOG, GR-FRAME, GP-ROW and GP-COLUMN. The attribute use the same information as EXPANDY. It's valid for all children that don't have any EXPANDY specified.

CHILDUNIFORMW

This attribute can be set to T or nil and be used on following controls: GP-DIALOG, GR-FRAME, GP-ROW and GP-COLUMN. The attribute use the same information as EXPANDX. It's valid for all children that don't have any EXPANDX specified.

DEFAULT

This attribute can only be used for GP-BUTTON controls and it can only be set to T or nil. If you add this to a button then it will be connected to the Enter button (as windows standard). If you define more than one GP-BUTTON as DEFAULT then it's arbitrary who button that will be DEFAULT since only one button can have this attribute.

ENABLED

The attribute can be T or nil. If the attribute is nil then the controller are disabled.
The attribute can be used on GP-BUTTON, GP-CHOICE, GP-EDIT, GP-LISTBOX, GP-TOGGLE and GP-RADIO.

EXPANDX

This attribute can be set to T or nil and can be used on all controls except for GP-DIALOG. As default this attribute is set to T and it allows the control to grow in X-directions to fill all available space. If you set this value to nil then the control shrink as much as possible.

EXPANDY

This attribute can be set to T or nil and can be used on all controls except for GP-DIALOG. As default this attribute is set to nil that means it will only take as much space as needed. If you set this attribute to T then the controller will grow in Y-direction to fill all available space.

FGCOLOR

Foreground color. The value assigned to this attribute is an integer created by the GP-RGBINT function. See also the BGCOLOR attribute.

FLAT

This attribute can be T or nil and be used on the GP-BUTTON dialog.
Example 13


```
(SETQ dlg (GP-DIALOG "Example 13"))
(GP-BUTTON dlg "FLAT" FLAT T)
(GP-BUTTON dlg "NOT FLAT")
(GP-SHOWMODAL dlg)
```

GAP

This attribute can be used in GP-ROW, GP-COLUMN and GP-FRAME. It controls the default distance between different objects in the controller.

HEIGHT

This attribute is an integer and is available for all controls. The value set the height of the control. If the control is expandable in Y then this value is the smallest possible value.

IMAGE

This attribute can be used on GP-BUTTON controls. If the value is nil then no image will be used. If the value is a object from GP-IMAGE then the image will be placed on the button.

RESIZABLE

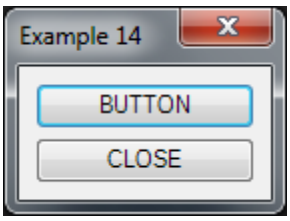
This value can be T or nil and be used on GP-DIALOG only. If the value is non nil then the dialog can be resizable.

RESPONSE

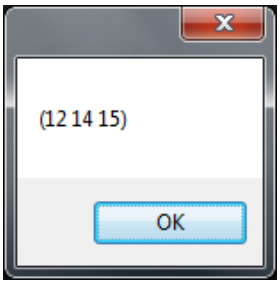
This attribute can be used on GP-BUTTON only. If the value is not nil then the dialog will close and the value of RESPONSE will be returned in the GP-SHOWMODAL function.

Example 14

This example will print (12 14 15)




```
(SETQ dlg (GP-DIALOG "Example 14"))
(GP-BUTTON dlg "BUTTON")
(GP-BUTTON dlg "CLOSE" RESPONSE (LIST 12 14 15))
(PRINC (GP-SHOWMODAL dlg))
```



UNIFORMH

The value of this attribute can be T or nil. The attribute can be used on all controllers except GP-DIALOG.
All children that have the same parent who have this attribute set to T will have the same height. The height will be that control that has the highest value.

UNIFORMW

The value of this attribute can be T or nil. The attribute can be used on all controllers except GP-DIALOG.
All children that have the same parent who have this attribute set to T will have the same width. The width will be that control that has the widest value.

VALUE

This attribute should have different type of values depending of controller.
GP-CHOICE (Integer), GP-EDIT (String), GP-LISTBOX (Integer), GP-TOGGLE (Bool) and GP-RADIO (bool)
The attribute set the value in the controller.

VERTICAL

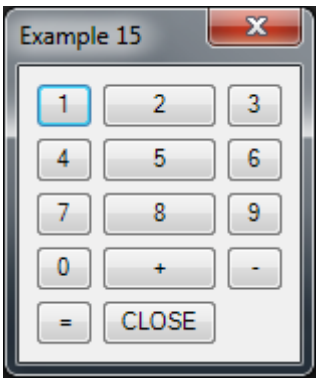
The attribute can be T or nil and it can be used on GP-ROW and GP-COLUMN.
The attribute is normally used internally. If you have a GP-ROW and set VERTICAL to T then the controller behave as a CP-COLUMN and inversely.

WIDTH

This attribute should be an integer and it's available for all controllers. The value indicates the smallest with the controller can have if the controller is expandable in X direction.

WRAPCOUNT

The attribute must be an integer and it can be used on GP-DIALOG, GP-ROW, GP-COLUMN and GP-FRAME controllers.
The value indicate how many controllers it should be on each line in a column (or how many controllers it should be on each column on a line). Default value for this attribute in 1. The WRAPCOUNT attribute makes it easier to create a nice table in the dialog, since the size of the controllers will be equal on each line and column.

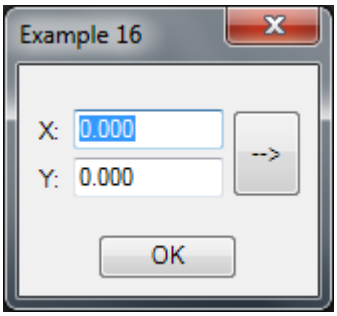



```
(SETQ dlg (GP-DIALOG "Example 15" WRAPCOUNT 3))
(GP-BUTTON dlg "1")
(GP-BUTTON dlg "2")
(GP-BUTTON dlg "3")
(GP-BUTTON dlg "4")
(GP-BUTTON dlg "5")
(GP-BUTTON dlg "6")
(GP-BUTTON dlg "7")
(GP-BUTTON dlg "8")
(GP-BUTTON dlg "9")
(GP-BUTTON dlg "0")
(GP-BUTTON dlg "+")
(GP-BUTTON dlg "-")
(GP-BUTTON dlg "=")
(GP-BUTTON dlg "CLOSE" RESPONSE T)
(GP-SHOWMODAL dlg)
```

Dialog examples

Example 16

In this example we have a dialog box, with X and Y value and a button that pick up the X,Y value from a point in IGEMS.




```
(SETQ x 0.0 y 0.0)
(DEFUN handler (object)
 (COND
  ((= object b:pick) (GP-CLOSE dlg T))
  ((= object b:ok) (GP-CLOSE dlg nil))
 )
```

```
)
(SETQ dlg (GP-DIALOG "Example 16" ACTION handler))
(GP-FILL dlg HEIGHT 10)
(SETQ row (GP-ROW dlg))
(SETQ column (GP-COLUMN row WRAPCOUNT 2))
(GP-LABEL column "X:")
(SETQ e:x (GP-EDIT column VALUE (RTOS x 3 T)))
(GP-LABEL column "Y:")
(SETQ e:y (GP-EDIT column VALUE (RTOS y 3 T)))
(SETQ b:pick (GP-BUTTON  row "-->" EXPANDX nil EXPANDY T ALIGN GPC-CENTER))
(GP-FILL dlg HEIGHT 10)
(SETQ b:ok (GP-BUTTON  dlg "OK" WIDTH 70 EXPANDX nil ALIGN GPC-CENTER))
(WHILE (GP-SHOWMODAL dlg)
  (SETQ pt (GETPOINT "Pick point:"))
  (IF pt
    (PROGN
      (GP-SETQ e:x VALUE (RTOS (CAR pt) 3 T))
      (GP-SETQ e:y VALUE (RTOS (CADR pt) 3 T))
    )
  )
)
```

ILISP command to control the CAD system

Our intension is to improve this part a lot in coming versions of IGEMS. Following commands are available for the moment.

(CAD-ARC <startpoint> <endpoint> <ccw> [color])

The function draws an arc and returns the object name. The optional argument [color] should be an integer from 1 to 255. If the [color] argument is omitted then current color will be used.

(CAD-CLOSESTPOINT <object> <point>)

The function returns the closest point on the object from the given point.
Example:

```
(SETQ obj (CAD-ENTSEL "Select object"))
(WHILE
 (AND obj (SETQ from (CAD-GETPOINT "Pick point: ")))
 (SETQ to (CAD-CLOSESTPOINT (CAR obj) from))
 (CAD-LINE from to)
)
```

(CAD-CLOSEDRAWING)

This function close actual drawing. The function returns T if the operation was successful else nil. **Note!** Please be aware of that this function will not save any drawing.

(CAD-CIRCLE <radius> [color])

The function draws a circle and returns the object name. The optional argument [color] should be an integer from 1 to 255. If the [color] argument is omitted then current color will be used.

(CAD-COPY <objects>)

The function copies the objects and returns a new object list or an object.
If you want to copy some object from one place to another place you also must use the CAD-MOVE command.

```
(SETQ from (LIST 0 0))
(SETQ radius 10)
(SETQ object (CAD-CIRCLE from radius))
(SETQ to (GETPOINT from "Enter a point" object))
(CAD-MOVE (SETQ newobjects (CAD-COPY object)) from to)
```

The example above will create a circle in coordinate 0,0 and the you can drag a copy to another point.

(CAD-COLOR <color>)

The function change current color. The <color> should be an integer from 1 to 255.

(CAD-DELETE <objects>)

The function deletes the objects from the drawing

(CAD-ENTSEL [prompt])

The function asks for an object and returns a list with the object name and the point.

(CAD-EXTENS <objects>)

The function returns a list with four reals describing the drawing extens (xmin ymin xmax ymax)

(CAD-EXPORTXML <objects> <filename>)

The <objects> argument is an object or a list of objects. The function creates a XML-file with information about the selected objects.

(CAD-GET <object> <key>)

This function makes it possible to collect information from different objects on the screen. If you have a list of object then you must check one object at a time. The function will return the requested information.

Key	On object types	Returns
"AREA"	Parts and sheets	This key can be used on parts and sheets.
"CENTER"	Arc and Circle	Returns a list with the center point.
"CLOSED"	Polylines	Returns T if the polyline is closed.
"COLOR"	All	Returns the color of the object as an integer
"CUSTOMER"	Part	Returns the customer name a string
"DBID"	Part	Returns the parts ID from the Organizer SQL database as an integer. If the part is not registered then the function returns -1
"EDGECOUNT"	Polylines	Returns number of segments in a polyline.
"END"	Line, Arc	Returns a list with the end point
"EXTENTS"	All	Returns a list with
"GUID"	All	Returns a unique windows GUID string
"INFO"	Sheets	
"LAYER"	All	Returns the layer name of the object as a string
"NAME"	Parts, sheets and cutorders.	A string with the name
"NCFILE"	Cutorder	
"QUANTITY"	Parts and Sheets	This will returns the quantity of a part. If it's not a part then the function returns nil
"RADIUS"	Arc and Circle	Returns a Real with the radius
"SELECTED"	All	Returns T if the object is selected else nil
"START"	Line, Arc	Returns a list with the start point
"TIME"	Cutorder	
"TYPE"	All	A string with that can be: "ARC", "LINE", "CIRCLE", "TEXT",

If you use a non-existing key then the function will return nil. By using the function CAD-SET you can add XDATA to the most type of IGEMS objects.

(CAD-GETPOLYSEGMENT <object><index>)
The function returns a list with ((start point) (end point) bulge)
Example: ((x y) (x y) bulge)

(CAD-GETANGLE [basepoint] [prompt])
The function asks for a point. The argument <prompt> is displayed on the command line. The optional [basepoint] argument draws a rubber band from the base point to actual crosshair position. The function returns the angle in radians or nil if no angle is given.

(CAD-GETCORNER <basepoint> [prompt])
The function ask for the opposite corner point. The argument <basepoint> must be given. The function returns a point or nil if no corner points are given.

(CAD-GETDIST [basepoint] [prompt])
The function asks for a distance. The argument <prompt> is displayed on the command line. The optional [basepoint] argument draws a rubber band from the base point to actual crosshair position. The function returns the distance or nil if no distance is given.

(CAD-GETPOINT [basepoint] [prompt])
The function asks for a point. The argument <prompt> is displayed on the command line. The optional [basepoint] argument draws a rubber band from the base point to actual crosshair position. The function returns the point or nil if no points are given.

(CAD-HATCH objects [spacing [radians [crosshatch [basepoint [color]]]]])
The function create a hatch from other geometries.
<objects> This is a list of objects. If no other arguments are given then the type of hatch will be a solid.
<spacing> If the value is zero then the type of hatch will be a solid. If it is a value then this is the distance between the lines in the hatch.
<radians> This is the angle of the hatch. If this value is not given then the angle is 45 degree. The argument should be given as radians.
<crosshatch> Should be T or nil
<basepoint> One of the hatch line will go thru this point. If no argument is given or if the argument is nil then the function will use the centroid.
<color> The color of the hatch. If no argument is given then the color will be actual color in the system

Example:

```
(SETQ entities (CAD-SSGET))
(CAD-HATCH entities 5.0 2.0 nil nil 2)
(CAD-DELETE entities)
```

(CAD-INSERTFILE <filename> <blkname> <inspos> <userpos> <explode> <insposlowleft>)
<filename> The file to be inserted in current drawing.
<blkname> The preferred name for the blocks to be inserted. If not possible the blockname will be decorated to a unique name. If "*" is used then IGEMS will set an automatic name for the block.
<inspos> The position the file is inserted at. Either this is the lower left point inserted drawing or the inserted point stored in the drawing is depending on the parameter <insposleft>.
<userpos>
<explode> If this argument is not nil then IGEMS will explode the inserted blocks before the functions returns.

<insposlowleft> If this argument is non nil then the lower point of the inserted drawing is used as insertion points, otherwise the insertion point stored in the drawing (normally 0,0) is used as insertion point.
The function returns a list of objects that was inserted.

(CAD-LAYER <name> [color])
The function changes the active layer. If the layer does not exist then the layer will be created. The optional <color> command should be an integer from 1 to 255.

(CAD-LINE <start point> <end point> [color])
The function draw a line between the two points and returns the object name. The optional argument [color] should be an integer from 1 to 255. If the [color] argument is omitted then current color will be used.

(CAD-MARKER <x> <y> [rgb-color])
Sets a visual marker at coordinate x,y. Also, optionally sets the color of the marker to an RGB encoded 32-bit integer 00RRGGBB. Default color is white.

(CAD-MIRROR <objects> <point1> <point2>)
The function mirror the <objects> thru <point1> and <point2>

(CAD-MOVE <objects> <from> <to>)
The function move the objects <from> <to>

(CAD-NEW [file name])
The function creates a new drawing. If the optional argument [file name] is given then this will be the default name of the drawing. If no name are given then the system will use a standard name like Noname1, Noname2 and so on. Note! The function do not create the file on the hard disk. It has to be saved as normal.

(CAD-POINT <point> [color])
The function draws a point in current point style at the <point> argument. The optional argument [color] should be an integer from 1 to 255. If the [color] argument is omitted then current color will be used.

(CAD-POLYBEGIN)
Returns a new polyline object. See also the CAD-POLYPOINT and CAD POLYEND functions.

(CAD-POLYPOINT <object> <x> <y> [<x-center> <y-center> <ccw>])
Add a segment to the polyline created with the CAD-POLYBEGIN function. If the argument <x-center> and <y-center> is used then the segment will be an arc.

(CAD-POLYEND <object> <color> [close])
Finish the polyline object created with the CAD-POLYBEGIN and CAD-POLYPOINT functions. The function returns the object name.
The example below will create a polyline and then delete it.

```
(SETQ obj (CAD-POLYBEGIN))
(CAD-POLYPOINT obj 0 0)                    ; startpoint of the polyline
(CAD-POLYPOINT obj 100 0 50 0 T)    ; adds a CCW arc segment to the polyline
```

```
(CAD-POLYPOINT obj 100 200)              ; adds a line segment to the polyline
(CAD-POLYPOINT obj 0 200 50 200 nil) ; adds a CW arc segment to the polyline
(SETQ handle (CAD-POLYEND obj 2 T))  ; Finish the closed yellow polyline.
(ALERT "The polyline object will be deleted")
(CAD-DELETE handle)
(CAD-REGEN)
```

(CAD-RECTANGLE <lowerleft> <topright> [color])

The function draw a rectangle between the corner points and returns the object name. The optional argument [color] should be an integer from 1 to 255. If the [color] argument is omitted then current color will be used.

(CAD-REDRAW)

After you have added object you must run this function to have them visible on the CAD screen.

(CAD-REGEN [objects])

The function regenerates the objects in the [object list]. If the [object list] is omitted then all objects are regenerated.

(CAD-REPLACE <objects>)

This function must be used to update the UNDO function.
Replace an exist object with a new object.

(CAD-ROTATE <objects> <angle>)

The function rotate the <objects> in an <angle> from the

(CAD-SET <object> <key> <value>)

This function makes it possible to change information on different objects on the screen. If you have a list of object then you must check one object at a time. The function will return the value.

Key	Returns
"COLOR"	Set the color of the object as an integer
"CUSTOMER"	Set the customer name as a string. This should p
"LAYER"	Set the layer name of the object as a string
"NAME"	Sets the name of the part
"QUANTITY"	Set the quantity of a part. If it's not a part then the function returns nil
"SELECTED"	Select object if the value is T.

If you use CAD-SET function with a non-existing key then this key will be added to the object. We call this information XDATA. You can save strings on all kind of IGEMS objects. It's a special handling for parts and parts definitions. If the key starts with a dot. Example: ".PAINTED" then the same XDATA will be added for all identical parts. If you add "PAINTED" it will be added to the selected part only. See also the CAD-GET function

(CAD-SSGET [mode] [pt1 [pt2]])

The function let the user select objects on the screen, if object are selected then the object names are returned in a list. The mode option has following alternatives.
If no argument is given then the user must select the objects

Mode	Meaning
"L"	Return the last object added to the drawing database.
"C"	Use Crossing type and need two points.
"W"	Use Windows type and need two points
"X"	Take all objects on the screen

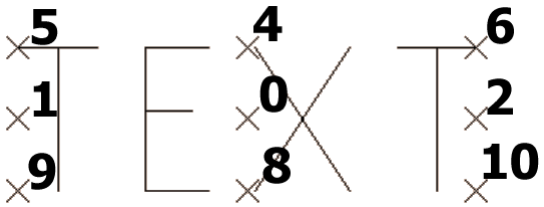
(CAD-SCALE <objects> <xscale> <yscale> <basepoint>)
The function scale the select objects in <xscale> and <yscale> around the <basepoint>

(CAD-SAVE <file name> [objects])
Save the objects specified as <objects> as a <filename>

(CAD-SAVEAS <filename>)
Save the drawing as the specified filename.

(CAD-SAVEIMAGE <objects> <filename> <width> <height> [border] [background])
The function creates an image. If no border is given the then the border is 3 pixels. If no background is given or zero then the background is transparent. The color is the same as the color number in the color command.

(CAD-TEXT <txt> <pos> <height> <angle> [color] [basepoint] [font])
Insert a text on the drawing. <txt> is the text to add,<pos> is the insertion point, <angle> is the angle in radians. The argument [color] is optional if it's nil then actual color will be used.
The [basepoint] is a value that controls where the text base point is placed. If the argument is omitted or nil then default base point 9 will be used.
[font] is an optional argument for the text font default is "ISOCP" which is the built-in single font You can also use one of the installed windows font, for example "Arial".



(CAD-ZOOMCH <height>)
The function centers the view at and a viewport of height <height>.
 is a list of the point that will be the new center of the screen.
<height> is a value that describe the height of zoom in actual units.

(CAD-ZOOMEXTENTS)
Zooms out that everything on the screen will be visible

(CAD-ZOOMWINDOW <pt1> <pt2>)
This function zooms a window given by two points.
<pt1> and <pt2> is lists of two reals that describe the position in X and Y

(TOOLS-CLEANUP <objects> <tolerance>)
returns a list of objects

Sheet value calculation script

The value

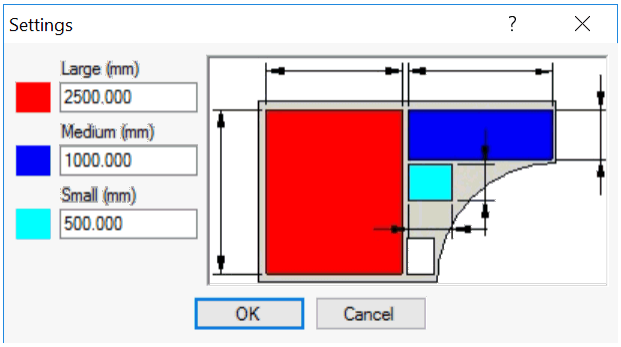
Following variables are available in the script:

SHEET-WEIGHT	Weight in Kg.
SHEET-AREA	Sheet Geometry Area. The holes in the sheet is removed from the external area. The units are in m^2
SHEET-THICKNESS	The Thickness of the material. The units are in mm.
SHEET-DENSITY	The weight of $1m^3$
SHEET-GROUP	The name of the material group
SHEET-QUALITY	The name of the material quality
SHEET-COST	The cost per kilo
SHEET-DX	Sheet length in X units mm
SHEET-DY	Sheet length in Y units mm.
SHEET-ISRECTANGULAR	T or nil.
*SHEET-NAME	The name of the sheet as a string.
SHEET-INFO	The info on the sheet as a string.
SHEET-REFERENCE	The Reference on the sheet as a string
SHEET-STORAGE	The Storage on the sheet as a string.
SHEET-SMALLSIZE	The Minimum rectangle size in Sheet Inventory
SHEET-MEDIUMSIZE	The Medium rectangle size in Sheet Inventory
SHEET-LARGESIZE	The Large rectangle size in Sheet Inventory

(SHEET-INVENTORY [<small> <medium> <large>])

Returns a list with the weight in kilo of each areas.

If the arguments are not given then the system uses the default values that can be found in the Settings option in the Sheet Inventory command.

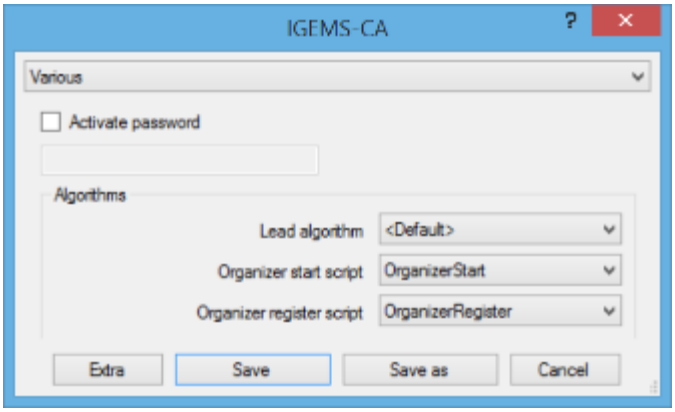


Connection IGEMS/Organizer with external ERP

Installation and workflow

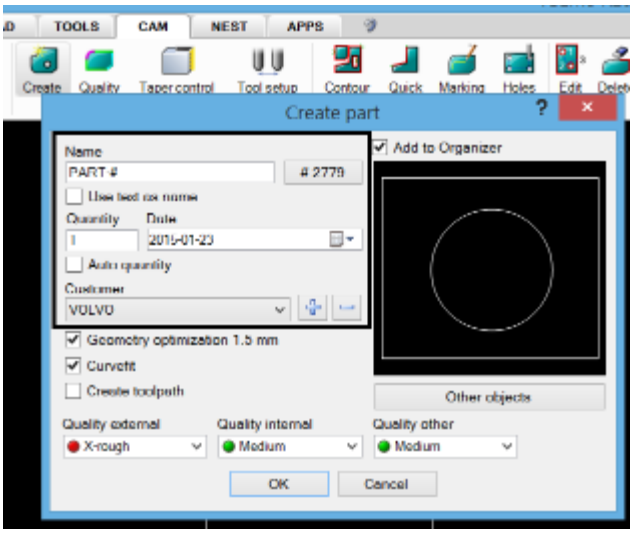
Today date 2015.05.14

1. Download and install version R2015.2.692 or newer.
2. Copy the file "OrganizerRegister.lsp" to folder "…/Shared/Algorithms/OrganizerRegister"
3. Copy the file "OrganizerStart.lsp" to the folder "…/Shared/Algorithms/OrganizerStart"
4. The best is to start with a complete new database. Delete the “Organizer.db” file located in the Organizer folder in Shared.
5. When registering a finish job, just select one sheet at a time.
6. Inside the files on the first line is a variable TARGETFOLDER
   (SETQ targetfolder "C:/ERP/") ; Set this variable to the communication folder
   Set this variable to a valid existing folder for the communication with the ERP.
7. In the Various tab in the machine settings, you can activate a script that will be loaded every time you register a part and every time you start Organizer.



Registration new parts in IGEMS/Organizer

When you convert basic geometries (lines, arcs, circles) to a part than the part will also get some production properties.



Those properties is following: Name of the part, Quantity, Date and Customer name.

If the checkbox “Add to Organizer” is activated then the part will automatically be stored in a special folder on the computer and the other information in a SQL database.

At the same time the program will start a LISP script. This script will open an output registration file. The name of this file is **OrganizerNewParts.txt**. The Script will add information in this file. The file will have one line for each part that has been registered. The file contain following information.

<ID> <"Name"><Quantity><"Date"><"Customer"> <"Material"> <"Quality"> <Thickness> <Area> <Length> <Estimated time>

Each field in are separated by a space, strings are between quotation marks.

Example:

```
6 "PART332" 0 "YYYY.MM.DD" "VOLVO" "Aluminum" "Standard" 20.0 739300 3549.3 420.2
7 "PART327" 0 "YYYY.MM.DD" "SKODA" "Aluminum" "Standard" 20.0 543772 2345.1 398.7
8 "PART334" 0 "YYYY.MM.DD" "AUDI" "Stainless Steel" "Standard" 12.0 662634 4210.9 1214.9
```

Since the ERP system will be the master in the system the script will always set the quantity to zero. It will always be the ERP system that desire when something should be produced. The ID is the IGEMS identification number. This number must be saved in the ERP system.

The ERP-system will probably need a unique internal "Article number". It's up to the ERP-system to rename the part name (above "PART332" "PART327" "PART334").

Register of the parts in the ERP system

It's now up to the ERP system to open the **OrganizerNewParts.txt** file read the information and add information into the ERP system. When the information is stored, then the ERP system will delete the file. When IGEMS will add new parts again, it will be in an empty file.

Important about ID and ArticleName

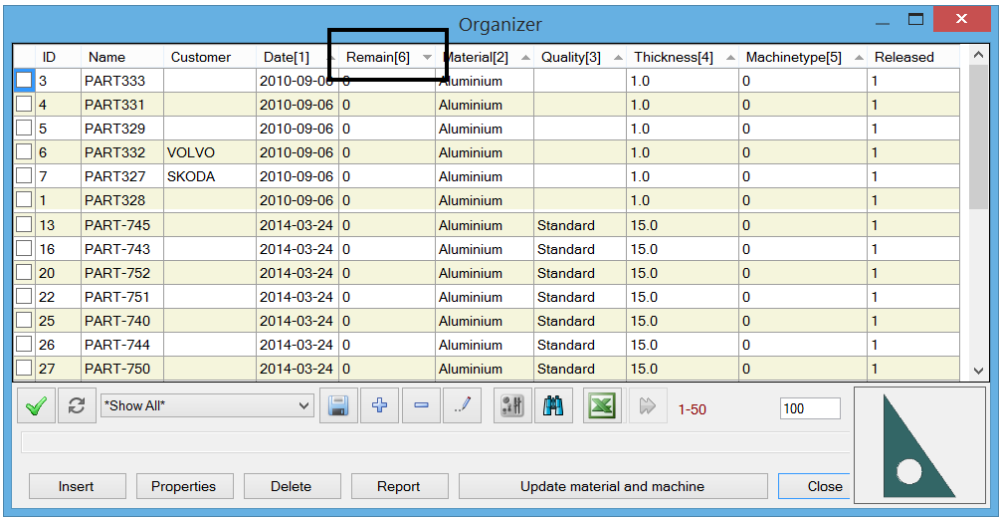
The ID is the IGEMS identification number. This number must be saved in the ERP system.

The ERP-system will probably need a unique internal "ArticleName". It's up to the ERP-system to rename the part name (above "PART332" "PART327" "PART334") to a correct name.

Organizer

In Organizer it's possible to see information about all parts that are saved. The operator will use Organizer in a normal way and this document do not cover this workflow.

The field "Remain" are set to zero and there is nothing to produce.



Creating a cutting order in the ERP system

The ERP system is the master in the system. If something should be produced then this is a decision from the ERP. When the system generate a production order then the ERP write information in a file named **OrganizerProduce.txt**. This file contains following information:

<ID> <nil><Quantity><nil><nil> <nil> <nil> <nil>

Example:

```
6 "ArticleName" 55 nil nil nil nil nil
8 "ArticleName" 34 nil nil nil nil nil
```

The meaning of this instruction is:
Produce 55 copies of part ID 6
Produce 34 copies of part ID 8.

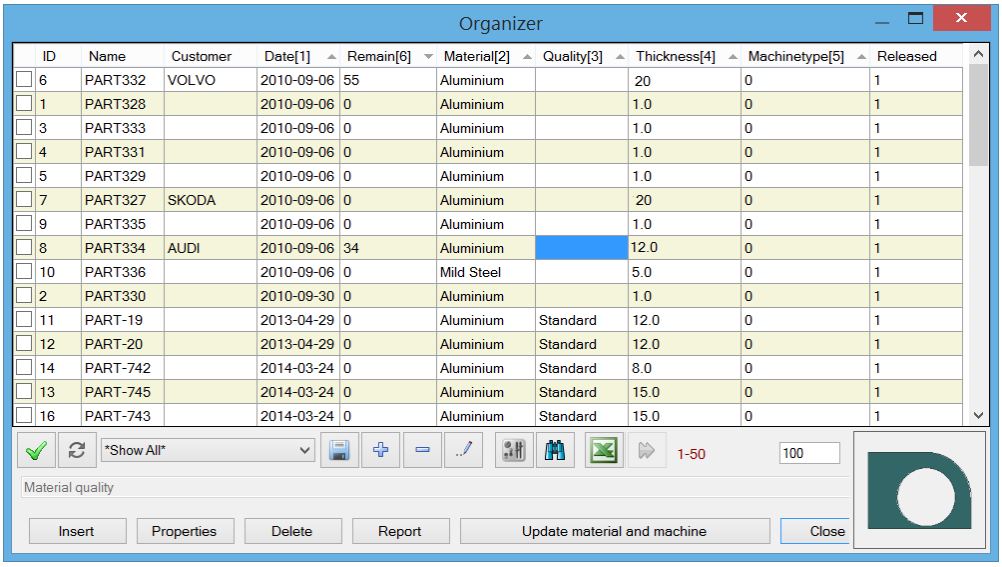
Other instructions

It's also possible for the ERP system to change other data in Organizer.
<ID> <"Name"><Quantity><"Date"><"Customer"> <"Material"> <"Quality"> <Thickness>
In the example above the correct "ArticleName" will be transferred to Organizer.
If the ERP system send any other information than nil then the part information in organizer will be updated with that information.
It's an extra possibility with the quantity instruction. By adding a plus (+) or minus (-) sign before the value the ERP system can add or reduce the number of parts that already are stored in organizer (incremental mode).

```
6 "ArticleName" +55 nil nil nil nil nil
8 "ArticleName" -2 nil nil nil nil nil
```

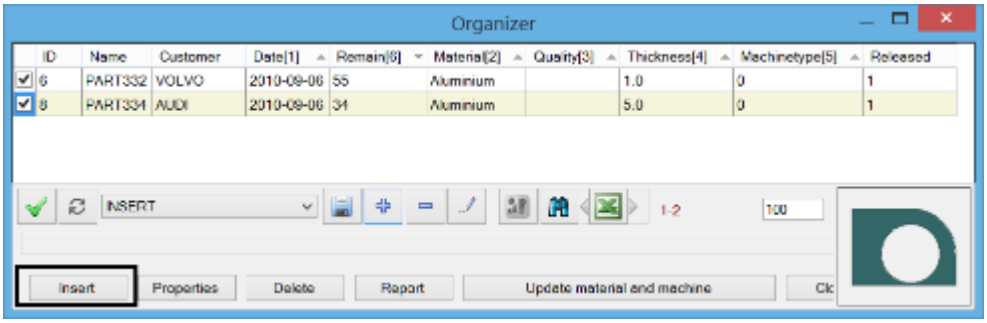
Receiving the production order in Organizer

Every time the operator start Organizer the program will look for the file **OrganizerProduce.txt**. If this file exists then the database is updated. When the database is updated then the file will be deleted. Organizer have now the updated information from the ERP system



ID	Name	Customer	Date[1]	Remain[6]	Material[2]	Quality[3]	Thickness[4]	Machinetype[5]	Released
6	PART332	VOLVO	2010-09-06	55	Aluminium		20	0	1
1	PART328		2010-09-06	0	Aluminium		1.0	0	1
3	PART333		2010-09-06	0	Aluminium		1.0	0	1
4	PART331		2010-09-06	0	Aluminium		1.0	0	1
5	PART329		2010-09-06	0	Aluminium		1.0	0	1
7	PART327	SKODA	2010-09-06	0	Aluminium		20	0	1
9	PART335		2010-09-06	0	Aluminium		1.0	0	1
8	PART334	AUDI	2010-09-06	34	Aluminium		12.0	0	1
10	PART336		2010-09-06	0	Mild Steel		5.0	0	1
2	PART330		2010-09-30	0	Aluminium		1.0	0	1
11	PART-19		2013-04-29	0	Aluminium	Standard	12.0	0	1
12	PART-20		2013-04-29	0	Aluminium	Standard	12.0	0	1
14	PART-742		2014-03-24	0	Aluminium	Standard	8.0	0	1
13	PART-745		2014-03-24	0	Aluminium	Standard	15.0	0	1
16	PART-743		2014-03-24	0	Aluminium	Standard	15.0	0	1

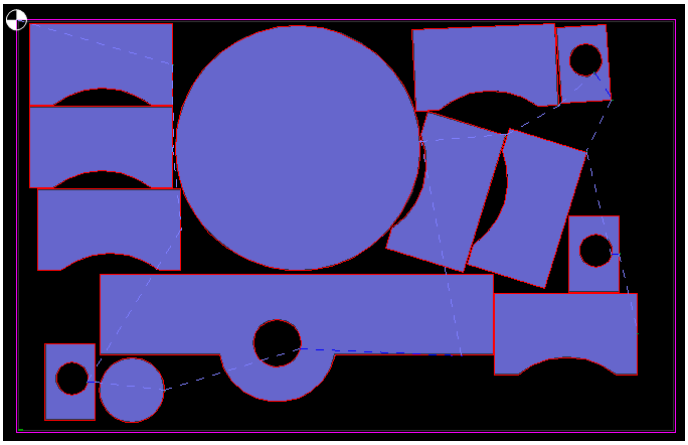
(You can see that ID 6 and 8 now have parts to produce)
The operator will always work with Organizer in normal way. The connection with the ERP system is completely invisible.



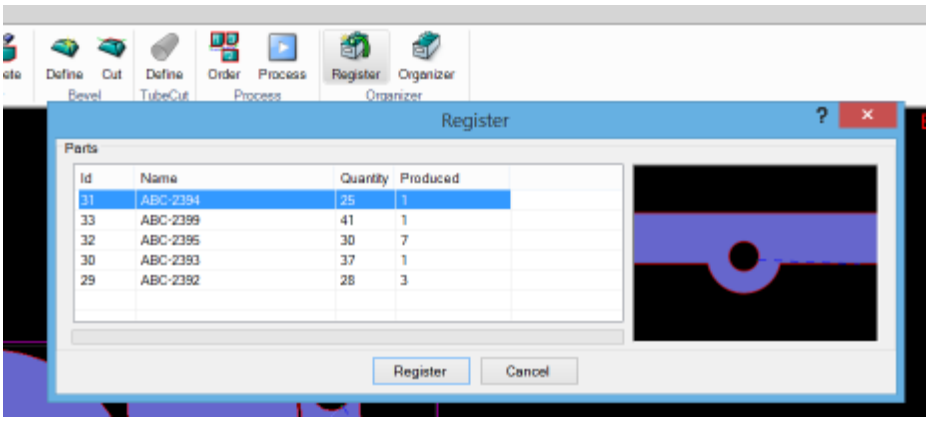
When setting the profile to INSERT and press the Insert button the parts will be inserted in IGEMS.

Registering that parts has been cut

You can nest and add the toolpath and make the CNC-file in normal way.



To register that the part has been included in a toolpath, press the “Register button”



This will show the “Register” dialog box. Here you can see short information about each part. If you accept then the organizer count down the number of copies to produce. The event will also start a script that will report to the ERP-system that the part has been added to a job. This script will create a text file with the name **OrganizerRegister.txt**

The file has following format:

<ID> <ArticleName><CountDown> <"Name of CNC-file"> <"Name of sheet">

Example

```
31 "ABC1" 1 "100.cnc" "Sheet-10"
33 "ABC2" 1 "100.cnc" "Sheet-10"
32 "ABC3" 7 "100.cnc" "Sheet-10"
30 "ABC4" 1 "100.cnc" "Sheet-10"
29 "ABC5" 3 "100.cnc" "Sheet-10"
```

The ERP system can use either IGEMS-ID or ArticleName as identification for count down.

When the ERP system has imported the information, then the ERP system should delete the file.

Final

The ERP-system is the master in the system.

The Organizer will be used locally for the operator, to handle what parts should be cut together and to organize the work for the day.

The organizer register script

This is an example of a register script:

```
(SETQ targetfolder "C:/ERP/") ; Set this variable to the communication folder
```

```
(IF (= *OLDDBID* -1)
 (PROGN
  (SETQ fw (OPEN (STRCAT targetfolder "ORGANZERNEWPARTS.TXT") "a"))
  (WRITE-LINE (STRCAT (ITOA *DBID*) " "
            (CHR 34) *NAME* (CHR 34)
            " 0 "
            (CHR 34) (ITOA (CAR *DATE*)) "." (ITOA (CADR *DATE*)) "." (ITOA (CADDR *DATE*)) (CHR 34) " "
            (CHR 34) *CUSTOMER* (CHR 34) " "
            (CHR 34) *MATERIAL* (CHR 34) " "
            (CHR 34) *ALLOY* (CHR 34) " "
            (RTOS *THICKNESS* 2) " "
            (ITOA *AREA*) " "
            (RTOS *LENGTH* 1 T)) fw)
  (CLOSE fw)
                                    ;(CAD-SET *object* "QUANTITY" 0) ; If you want to set the quantity to zero on the drawing
…                                    .;(CAD-DELETE *object*) ; If you want to delete the part on the drawing
  (SQL-SET *DBID* "quantity" 0)
  (SQL-SET *DBID* "remains" 0)
 )
)
(IF (> *PRODUCED* 0)
 (PROGN
  (SETQ fw (OPEN (STRCAT targetfolder "ORGANZERREGISTER.TXT") "a"))
  (WRITE-LINE (STRCAT (ITOA *DBID*) " "
          (CHR 34) *NAME* (CHR 34) " "
          (ITOA *PRODUCED*) " "
          (CHR 34) (CAR *NCFILES*) (CHR 34) " "
          (IF *SHEETS* (STRCAT (CHR 34) (CAR *SHEETS*) (CHR 34))  "nil")) fw)
  (CLOSE fw))
)
```

The Organizer start script

```
(SETQ targetfolder "C:/ERP/") ; Set this variable to the comunication folder
(DEFUN DateToList (datestr / year month day) ; The function convert a datestr example: "2015.3.15" to a list (2015 3 15)
 (SETQ year "" month "" day "" q 0)
 (FOREACH s datestr
  (COND
   ((= s ".") (SETQ q (1+ q)))
   ((= q 0) (SETQ year (STRCAT year s)))
   ((= q 1) (SETQ month (STRCAT month s)))
   ((= q 2) (SETQ day (STRCAT day s)))
  )
 )
 (LIST (ATOI year) (ATOI month) (ATOI day))
)


(IF (FILE-EXISTS (STRCAT targetfolder "ORGANIZERPRODUCE.TXT"))
 (PROGN
  (SETQ fr (OPEN (STRCAT targetfolder "ORGANIZERPRODUCE.TXT") "r"))
  (WHILE
   (SETQ txt (READ-LINE fr))
   (SETQ txtlist (READ (STRCAT "(" txt ")")))
   (SETQ id (CAR txtlist))
   (IF (SETQ name (NTH 1 txtlist)) (SQL-SET id "name" name))
   ; Se if there is a + or - sign
   (SETQ fnuts 0)
   (FOREACH tk name (IF (= tk (CHR 34)) (SETQ fnuts (1+ fnuts))))
   (SETQ tk (ASCII (STRTRIM (STRSUB txt (+ (STRLEN (ITOA id)) (STRLEN name) 4 fnuts)))))
   (SETQ absolut (IF (OR (= tk 43) (= tk 45)) nil T))
   (COND
```

```
    ((NOT (NTH 2 txtlist)) nil)
    (absolut
      (SETQ quantity (NTH 2 txtlist))
      (SQL-SET id "quantity" quantity)
      (SQL-SET id "remains" quantity)
      (SQL-SET id "produced" 0))
    ((NOT absolut)
      (SETQ addons (NTH 2 txtlist))
      (SQL-SET id "quantity" (+ (ATOI (SQL-GET id "quantity")) addons))
      (SQL-SET id "remains" (+ (ATOI (SQL-GET id "remains")) addons)))
   )
   (IF (SETQ datum (NTH 3 txtlist))
    (PROGN
      (SETQ datelist (DATETOLIST datum))
      (SQL-SET id "productiondate" (SQL-DATE datelist))))
   (IF (SETQ customer (NTH 4 txtlist)) (SQL-SET id "customer" customer))
   (IF (SETQ material (NTH 5 txtlist)) (SQL-SET id "material" material))
   (IF (SETQ alloy (NTH 6 txtlist)) (SQL-SET id "quality" alloy))
   (IF (SETQ thickness (NTH 7 txtlist)) (SQL-SET id "thickness" thickness))
  )
  (CLOSE fr)
  (FILE-DELETE (STRCAT (STRCAT targetfolder "ORGANIZERPRODUCE.TXT")))
 )
)
```

Following variables are automatically set every time a part is registered and the OrganizerRegister.LSP file is loaded.

ALLOY	The Quality of the material
AREA	The area of the part in mm2
CUSTOMER	The customer name
DATE	A list with 3 integers containing (Year month day)
DBID	The database ID that the part will have in Organizer.
LENGTH	The total circumference of the part
MACHINE	The name of the machine
MACHINETYPE	The machine type: 0=AWJ, 1= Pure water
MATERIAL	The material
NAME	The name of the part as a string as defined in the Create part command
NCFILES	A list of NC-files
OBJECT	The object id in the CAD system. This can be used to delete the part from the drawing or modify the quantity
OLDDBID	If it’s a new part that has not been registered in organizer then this value is always -1. Else the value is the same as *DBID*
PRODUCED	Number of parts that has been produced. If it’s a registration of a new part then this value is 0.

QUANTITY	Quantity
SHEETS	A list of sheets
THICKNESS	Material thickness

(SQL-DATE <year month day>)

The date format in the SQL server is different from normal way of entering dates. To convert to a SQL-DATE format you must use this function. The function takes a list of three integers and returns a string with the SQL-DATE format. This format must be used when modifying dates in the database. Example

(SQL-DATE (LIST 2015 04 15)) returns "42109.0"

Note! The function SQL-STRINGTODATE makes an opposite conversion.

(SQL-GET <id> <key>)

This function returns the value from the key column on the id row in the database. Se list later in this chapter. All values will be returned as strings.

(SQL-RUN <string>)

This function execute a SQL command and return the value.

(SQL-SET <id> <key> <value>)

The function set values in the SQL database. The value do not have to be strings, since this will be converted automatically.
ID is the database id of the part,
KEY is one of the keys (se later in this chapter).
VALUE the value that should be set.

(SQL-STRINGTODATE <SQL-DATE>)

The date format in the SQL server is different from normal way of entering dates. To convert the special format to a list of three integers (year month day) use this function.
Example:

(SQL-STRINGTODATE "42109.0") returns (2015 4 15)

Note! The function SQL-DATE makes an opposite conversion

Standard key field in the Organizer database

Key	Description
NAME	The name of the part
CUSTOMER	Name of the customer
SIZEX	The size in X of the part
SIZEY	The size in Y of the part
AREA	The area of the part in mm2 or inch2
WEIGHT	The weight of the part as Kg or lb
LENGHT	The total circumference of the part.
CONTOURS	The number of contours of the part
MATERIAL	The material name
QUALITY	This is the same as alloy that are used in other functions
THICKNESS	The material thickness
MACHINE	The name of the machine
MACHINETYPE	Machine type default =0 = AWJ
QUANTITY	The number of parts to produced
PRODUCED	The number of parts that has been produced
REMAINS	The number of parts that remains to produce
PRODUCTIONDATE	This is the date that was entered in the Create part command.
REGDATE	This is the date that the part was registered in the database.
NOTE	The Note in the Organizer
RELEASED	The value can be 0 or 1
All user fields that has been added in organizer can be used	

ILISP functions for the CAM module

(CAM-CANVAS <part>)
Create a canvas image

(CAM-CONTOURMULTI <list of parts>)
This function will add toolpath on all parts in the list. It will always use the current settings of the Contour command.
<list of parts> This is normally the list that are returned from CAM-CREATEPART. The argument can also be a part

(CAM-CUTORDER <list of parts>)
This will create a cut order. It will use the settings in the cutorder dialog.

(CAM-CUTORDERRAW <list of parts>)
This will create a cut order, the parts will be selected as the list is sorted.

(CAM-CREATEPART <objects> <other objects> <name> <quantity> <date> <customer> <ext qua> <int qua> <other qua> <geometry opt > <curve fit>)
This function create a part in IGEMS and returns a list of created parts.
<Objects> A list of objects that should be used for the parts
<Other objects> A list of objects that should be used as other objects.
<Name> A string that describes the name. The name can have "#" and use automatic numbering.
<Quantity> the number of parts that should be cut
<Date> if you want to use the date if the day, then set this variable to nil. If you want to set another date then use a list of three integers that describe the year month and day. Example: (2015 3 27)
<Customer> a string with the name. If no customer should be given then use an empty string "".
<ext qua> The quality for external quality between 1 to 5. 1 is X-rough and 5 is X-fine.
<int qua> The quality for internal quality between 1 to 5. 1 is X-rough and 5 is X-fine.
<Other qua> The quality for other objects between 1 to 5. 1 is X-rough and 5 is X-fine.
<Geometry optimizing> T if geometry optimation should be used else nil
<Curvefit> T if Curvefit should be used else nil.

(CAM-CREATESHEET <name> <xsize> <ysize> <collar>)
Creates a rectangular sheet at with <xsize> and <ysize> and <collar>

(CAM-INDEXTOOBJ <index>)
Returns an object name that can be used by CAD-GET to get information about the part while postprocessing. The index number must come from the cut order in the postprocessor

(CAM-LOADMAC <machine>)
The function load actual machine with latest used cutting parameters.
From version R2017.2.1317 it also set all LISP variables that belong to the machine.

(CAM-LOADMACMAT <machine> <group> <quality> <thickness>)

(CAM-MATINFO)
The function returns a list with ("NAME" "QUALITY" "THICKNESS" "DENSITY")

(CAM-MACINFO)
The function returns a list with ("NAME" "TYPE")

(CAM-OPENSHEETFILE)
Open matching sheet file.

(CAM-PARTDATA <object>)
Returns a list (cutting time and cutting length)

(CAM-PARTIMAGE <objects> <filename><width> <height> [border] [backcolor])
The extension of the file name must be included and sets the type of file. PNG, JPG and BMP is suppoted
Width, height, border is size in pixels.

(CAM-PROCESS <cutorder><filename><option>)
The command run the postprocessor and creates a filename. The option should be 6. More documentation will come on different options.

(CAM-REGISTER <list of parts>)
Register the parts in Organizer and returns the database id as a list

(CAM-SAVEPREPIMAGE <filename>)
This function saves the picture shown in the postprocessor window. You can include a full path and extension in the filename. The extension can be JPG, PNG, BNG. If no extension is given the default type is PNG. The function returns T if the operation success. In other case no. This function will only work if you postprocess from the normal postprocess command.

(CAM-SETZEROPOINT <cutorder> <pt>)
The command modifies the zero point of the cut order. The coordinate is in the coordinate system from the CAD-system.

(CAM-UNIQUEPARTS <objects>)
The <objects> can be one object or a list of objects. The function will return a list of unique parts. Other objects than parts will not be member in the list.
Example:
If you have 10 parts A and 5 parts B and 1 part C then your objects list will contain 16 parts. The function will return a list of three parts (A B C)

(TOOLS-CLEANUP <objects> <tolerance>)
The command runs the cleanup command on the objects in the given tolerance in mm.

(CALCAWJSPEED <quality> <thickness>)
Ruturnerar en matning

Lead script

By holding down the CTRL the same time as you press the Favorites button you can edit the script. The script may only be changed if you have experience of LISP programming.

Variables that holds information

This variables is always set when the script is in use.

LEAD-YSIZE	Real	The size in Y in mm
LEAD-HOLE	Bool	T if it's an internal geometry else nil
LEAD-CLOSED	Bool	T if it's a closed geometry else nil.
LEAD-LENGTH	Real	The perimeter of the geometry in mm
LEAD-AREA	Real	The area of the hole if it's a hole else the area of the part.
LEAD-XSIZE	Real	The size in X in mm
LEAD-CIRCLE	Bool	T if it's a circular hole else nil

You can also use all machine and material variables in the script.

(LEAD-SET type name dynmax dynmin inradius inangle outlength outradius outangle overcut piercingtype)

Type : 0=Outer 1=Inner 2=Corner 3=Alternative
If dynmin < dynmax then the lead will dynamic
piercingtype 0-6
inangle och outangle are in degree.

Old reports system (before 2018.4)

Overview

When running a report in IGEMS a template report file is populated with data from IGEMS and generates a document that can be save and/or printed. The template files have extension .tig. For every type of report you can make your own customized reports of that type.
The reports are located in the IGEMS shared folder under the folder Reports. Each type of report has its own subfolder.

- CostEstimate
- Inlay
- Nest
- Organizer
- Postprocessor
- SheetInventory

These are the different types of reports shipped with IGEMS.
In each subfolder all the reports of that type are placed.
A report consists of the following files.

- filename.tig
  - This is the report template
- filename.xml
  - This is a settings file with all LISP tags and other settings
- filename.lsp
  - This is the startup-script that can be attached to a report

The report system has two states. The generated report and the edit state.
To switch between the generated report and the edit state press *IGEMS/Toggle report view* or press F5.

IGEMS is shipped with a number of standard reports. To customize a report you need to manipulate the report template. It is not possible to change the standard reports. To create a custom report you can do that in several ways.

Create a custom report using the standard report as a template.

- Run a standard report and press F5 to switch to edit mode.
- Select *File/Save as...* and save the report template in the same folder under another name.
- You can now start editing your own custom report.
- When running the report from IGEMS a dialog will appear and prompt you to select which report to run.

Create a custom report from scratch

- Run a report and press F5 to switch to edit mode.
- Select *File/New* to create a new document.
- Select *File/Save* and save the file in the same folder.

APP reports

Reports can also be generated from the APP section in IGEMS. Here you can make your own totally custom reports. You have to write a LISP app to generate the report data and write a report template file. This will be covered in a separate section below.

Editor overview

The report editor is a simple word processor with built in report features. You can do most common word processing tasks. The generated report can be manually edited before saved or printed. You can export the document to several different formats including .rtf, .doc, .docx, .html, .pdf, .rtf, .xml, .txt. The normal word processing features will not be covered in this document, please contact our support if you need help. The exception is tables. Tables are used extensively when writing report templates so a few notes are in order.

Tables

To insert a table in a document select *Table/Insert/Table* from the menu.

Type in the number of rows and columns and press ok.

A table is now inserted. The table has all grid lines ON as default. To change the properties of a table place the cursor in a table cell and select *Table/Select/Table* and then select *Table/Properties...*

A dialog box is presented where you can alter the appearance of a table or individual cells of a table. You can set which grid lines of a table or cell are visible and change the background color etc... In the second tab “Size and formatting” there are two check-boxes that are important.

- Allow row to break across pages
  - If this box is checked a table row can be broken on multiple pages. If you want a table row to stay on one page you must uncheck this box.
- Repeat as header row at the top of each page
  - If you select a row in a table and check this box that row will be repeated at the top of each page if the table spans multiple pages.

Tags

A tag is a text field in the template that will be replaced with data when generating the report.

When you move the mouse over a tag the cursor will change to a “hand”. This indicates that the tag has special meaning. You can change the displayed name of the tag, you can delete a tag and you can edit a tag.

Double input position. When placing the cursor in a tag the tag is highlighted. As long as the tag is highlighted you can edit the displayed name of the tag. When the cursor is at the start or end of a tag you can press the *Left Arrow* key and *Right Arrow* key to leave the tag. This is called a double input position.

When the report is generated the tag is replaced by the data in the tag. The formatting of the tag is retained in the report. All properties of the tag like Font, Size, Color, Bold, Italic, Alignment etc is retained.

Example: We have a tag called Name with data IGEMS Report

Name -> ***IGEMS Report***

Multiple data tags

A tag can contain multiple data. For example if you run the CostEstimate report the tag Part.Name will contain the name of all the parts. If you place the tag in the main text of the document it will be replaced with the data for the first part. The only way to display all data of a tag is to place it in a table. If a tag is placed in a table the table will expand and show all data for that tag.

Example:

Name	**Quantity**	**Cutting cost**	**Material cost**	**Total cost**
Name	Quantity	CutCost	MatCost	TotalCost

The first row is normal text and does not contain any tags.

The second row contains tags with multiple data.

When running the report this table will expand and will look like this.

Name	Quantity	Cutting cost	Material cost	Total cost
PART-36	5	87,93 kr	106,70 kr	973,16 kr
PART-37	12	113,01 kr	447,32 kr	6.723,90 kr
PART-38	2	148,44 kr	289,35 kr	875,58 kr

Adding tags

To add a tag you must be in edit mode.
In edit mode you will have a tree structure on the right side in the editor.
This tree view contains all the data tags available for the report.
By double clicking on a tag in the tree view the tag is inserted in the document.

Deleting tags

To delete a tag just delete the whole tag using the *Del* or *Backspace* keys.

Editing tags

To edit the properties of a tag you double click the tag.
When double clicking a dialog will appear where you can change the properties of the tag.
What properties you can change depends on the type of the tag.
When editing properties of a tag that affects only the tag edited in the document.

Tag types

String

The tag is replaced by a string

Int

The tag is replaced by an integer

Currency

The tag is replaced by a currency using the currency settings in Windows

Double

The tag is replaced by a double
You can change the display name, number of decimals and if the unit should be visible.

Date

The tag is replaced by a date in the Short date format defined in Windows.

Time

The tag is replaced by a time in HH:MM:SS format
You can change to Decimal hour and then the time is shown in HH.## format.
Example 17:03:02 will be displayed as 17.05

Image
The tag will be replaced by an image
When an image tag is placed in the report you can use the grips to resize it to fit your needs.

LISP
A LISP tag or user defined tag is a special tag that the user creates. Above the tree view you have a + button called “Add user defined tag”. If you press this button a dialog appears where you can create your own tag and write a LISP script. LISP tags will be covered below.

Special tags

Special tags are placed under the IGEMS meny item. These tags are not editable.

Tag	
Date	Will be replaced by the current date
Time	Will be replaced by the current time
Pages	Will be replaced by the total number of pages
Pagenumber	Will be replaced by the current page number

LISP tags

Press the “Add user defined tag” above the tree view in edit mode.
Enter the name of the tag to create.
Now the Edit LISP dialog will appear.
Here you can write your custom tag and use all the tags already defined for the report.
By double clicking on a tag on the right the correct LISP syntax is inserted in the editor.
The value of the LISP script will be the value of the tag. By pressing the Eval button the value will be displayed.

Examples:
(+ (TAG "Part.CutCost") 10)
This will add 10 to the CutCost of each part

(strcat (TAG "Part.Name") "#")
This will append a # after the name of each part

(setq a 100)
This tag will have the constant value of 100

(TAGCNT "Part.Name")
This will return the number of multiple data for this tag

(TAG "Part.Name" 3)
This will return the name of the fourth data for the tag “Part.Name” (zero based index)
When adding the index this tag will be constant and always return the same value.

(TAG "Part.Name")
This will return the name of the data for the tag “Part.Name”

This value will change when this tag is placed in a table

So, by using LISP tags you can make calculations to fine tune your reports.
The user defined tags are added to the tree view under the LISP branch.

Conditional sections

You can add conditional segments to a report using the following syntax.
{IF TAG … ENDIF}
If the tag after the {IF is evaluated to 1 the part between {IF and ENDIF} will be visible in the report.

Example:
{IF ShowInfo
Part.Name
Part.Customer
ENDIF}

Startup script

Every report can have a startup script connected to it. To edit or create a startup script select *IGEMS/Startup script*
Now a LISP editor is opened where you can write a LISP application that will automatically be run before the report is generated.

In this LISP application you can create tags that can be used in the report.
You can display a dialog box if you like.
You can also do anything else you like, for example export data or communicate with other systems.

In the startup script you have the following special functions for handling reports.
(TAG *Name Index*)

- Name is the name of the tag
- Index is the index for multiple data tags
- Returns the value of the tag at Index

(TAGCNT *Name*)

- Name is the name of the tag
- Returns the number of data rows for the tag

(SETTAG *Name Value [Description]*)

- Name is the name of the tag
- Value is the value of the tag and can be of the following types
    - String
    - Double
    - Int
- Description is optional and if used will be displayed in the tree view when the tag is selected.

So, by using a startup script you can create a set of custom tags that can be used in the report. You can for example create a startup script that displays a dialog box where the user can enter a “Preparation cost”. This “Preparation cost” can then be used in the report.

To create multiple data tags you just call SETTAG multiple times with different Values.
Example
(SETTAG “Special.Users” “Bo”)
(SETTAG “Special.Users” “Inge”)
(SETTAG “Special.Users” “Nils”)
(SETTAG “Special.Users” “Patrik”)

Example.
This example will create a tag with a modified Part.CutCost that adds 10 to each current Part.CutCost.

```
(setq idx 0)
(setq rows (TAGCNT "Part.CutCost"))
(repeat rows
(SETTAG "Part.CutCost2" (+ (TAG "Part.CutCost" idx) 10))
(setq idx (+ 1 idx))
)
```

Printing

Every report template can have a printer connected to it. This can be any installed printer. To select a printer for the report select *IGEMS/Set printer*
The printer you select here will be preset when printing and used if quick printing this report.
It will also be used if running a report for direct printing.

APP reports

It’s possible to create a totally custom report from the APP section in IGEMS.
You have the following special functions to use

(REPORT-INIT)

- Must be called before using any of the other functions!

(SETTAG *Name Value [Description]*)

- Name is the name of the tag
- Value is the value of the tag and can be of the following types
    - String
    - Double
    - Int
- Description is optional and if used will be displayed in the tree view when the tag is selected.

(SETTAGIMAGE *Tagname Filename Width Height*)

- Tagname
    - The name of the tag
- Filename
    - The name of an image file (.png, .bmp, .jpg...)
- Width

    - Size of the image in the report
- Height
    - Height of the image in the report

(SETTAGEMF *Tagname Ents SizeX SizeY Width Height*)

- Tagname
    - The name of the tag
- Ents
    - An entity or list of entities to create the image of
- SizeX
    - Width of the EMF image
- SizeY
    - Height of the EMF image
- Width
    - Size of the image in the report
- Height
    - Height of the image in the report
- Use 300 as a start value for SizeX, SizeY, Width and Height

(REPORT-RUN *template [resfile] [print]*)

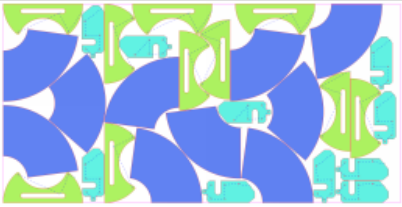
- Template
    - The report template to run
- Resfile
    - a .doc or .pdf filename
    - If used the report will not be visible but automatically saved to resfile
- Print
    - If a resfile has been defined and print=1 then the report is automatically printed to the printer set in the template

Converting old reports

Just replace the old <<TAG>> syntax with the new tags in the report template file.

New report system (from 2018.4)

Date	2018-05-29 14:19
Drawing file	C:\dwg\rep2.dig
Material	Stainless Steel/Standard 1 mm



Cutting			**Material**	
Piercing time	00:03:03		Enclosing	1997,26x1020,00 mm
Cutting time	00:39:53		Material cost	108,57 kr
Total time	00:48:54 (0,815)		Material cost/weight	6,00 kr
Cutting length	37735,738 mm		Material cost/area	48,00 kr
Machine cost/hour	130,00 kr			
Tool cost/hour	10,00 kr		**Estimated total cost**	**258,71 kr**
Abrasive cost	1,00 kr			
Cutting cost	133,47 kr			
Handling time	00:20:00			
Handling cost	16,67 kr		(50,00 kr/hour)	

Name	Quantity	Cutting cost	Material cost	Total cost
PART-27	10	3,37 kr	1,67 kr	50,35 kr
PART-20	10	4,37 kr	6,68 kr	110,58 kr
PART-24	10	5,60 kr	2,51 kr	81,11 kr

Report

When a report is generated it is opened in a word processor. Here you can modify the report using the ribbon style user interface.

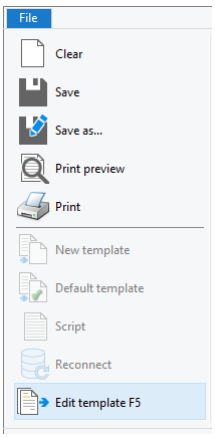
You can then print and/or save the report.

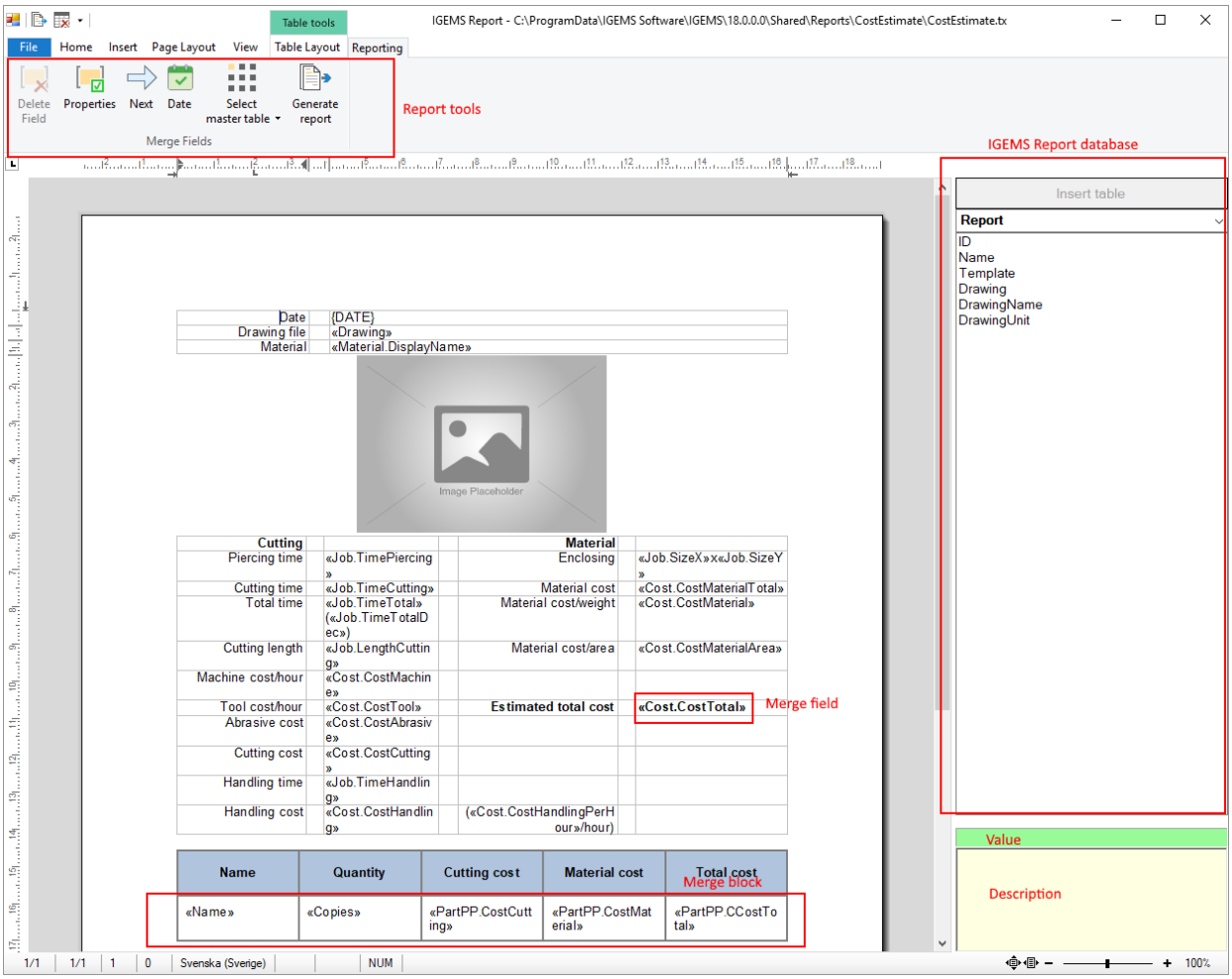
Template

The report is generated using a report template. The template is populated with data from IGEMS.

To modify the template, you have to enter the “Edit template” mode.

Go to the menu File and select Edit Template or press F5. F5 toggles between Report-mode and Template-mode





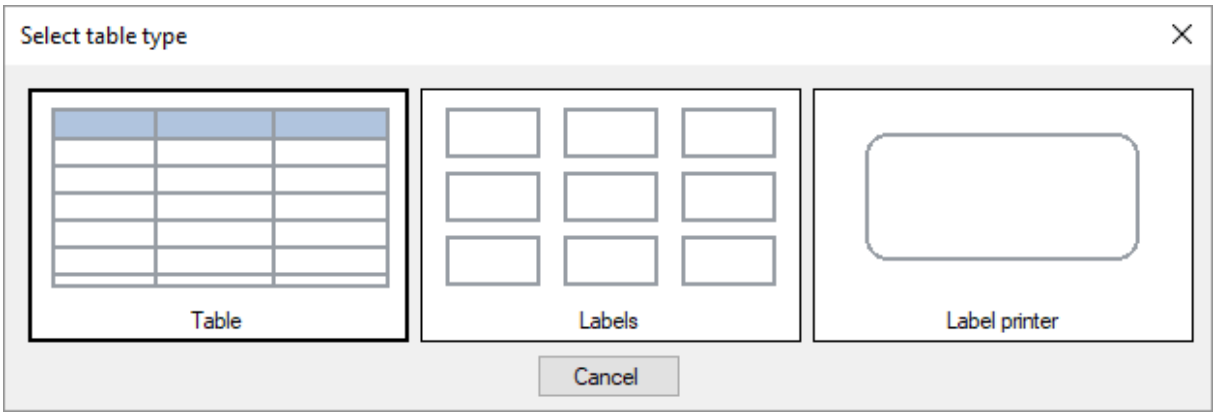
In template mode you can edit the template that controls the report. After editing you press F5 or the button “Generate report” to come back to Report mode with the updated template.
To the right is a panel with the data from IGEMS.

Merge field

A merge field is a tag from the database that will be populated with data when running the report.
To insert a merge field just place the cursor in the document and double click on the field in the right panel.
To delete a merge field just select the field with the mouse and press delete or the “Delete field” button.
To change the properties of a field, like number of decimals etc… just double click on the field or press the “Properties” button.

Merge block/Repeating table

A merge block repeats the data in a table. To create a repeating table you have to select the table in the right panel and press “Insert table”.

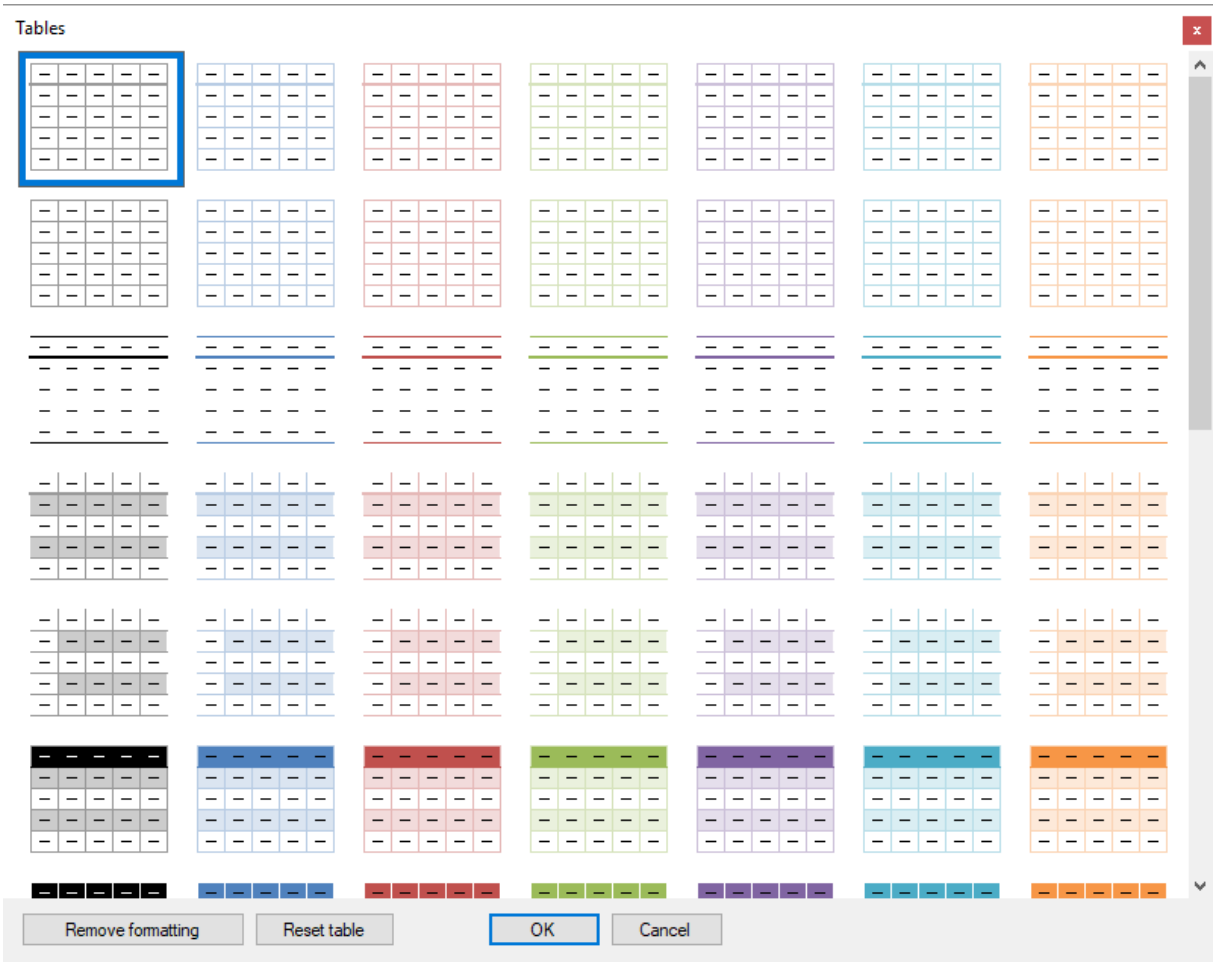


When pressing “Insert table” you get a selection of what type of table to insert.
For normal repeating tables choose “Table”. The two other types of tables are described under “Labels”.
You are prompted to select the number of columns in the table. The first row is not a repeating block and should be used for setting the name of the table column but you can also delete it.
After a merge block table has been inserted you can add merge fields to it.

Tables video

Table design

It is possible to select the style of a table from a predefined list of designs. Just double-click on a table or choose Table layout/Design.



This will bring up the tables design dialog. Select the design you like and press OK.

- Remove formatting
  - The design will be removed from the table.
- Reset table
  - The table will be restored to a simple default style.

Special fields

Date

The date field inserts the current date.

Next

The next field is a special field that can be used to advance to the next row in a table. This is useful for label reports. See Labels for more information.

New template

Select this to create a new template.

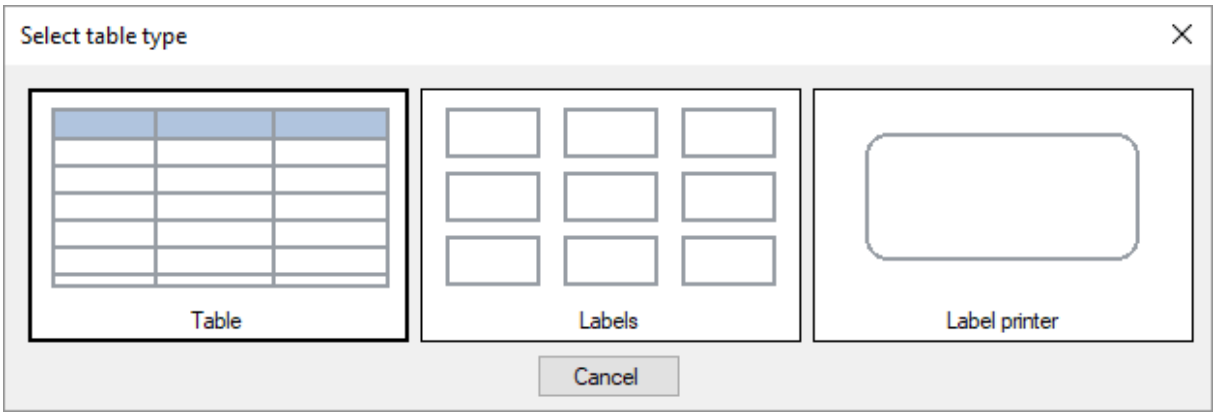
Default template

Select this to insert the default template shipped with IGEMS.

Labels

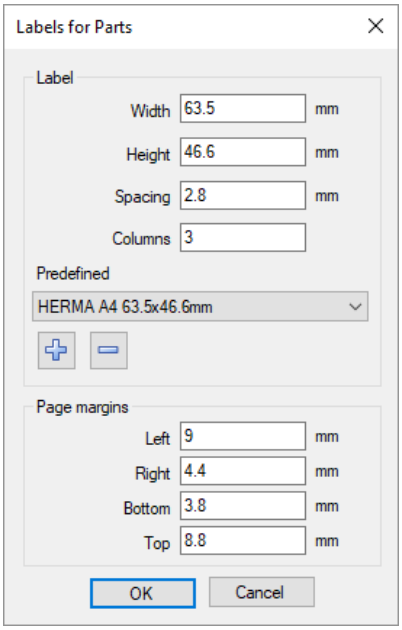
You can generate reports for label printing.

Labels are created using tables. So, you select the table you want to use and press "Insert table" in the right panel.



To create labels for a normal printer with a document of labels choose "Labels". To create labels for a label printer with one label per page choose "Label printer".

When choosing "Labels" the Labels configuration dialog is shown.



This dialog sets up the labels.

Width and Height is the with and height of the label.

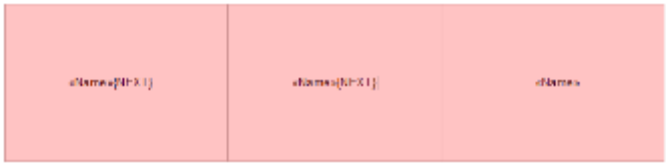
Spacing is the space between two columns.

Columns are the number of labels on one row.

Page margins sets up the margins of the page.

Predefined have a list of sample labels.

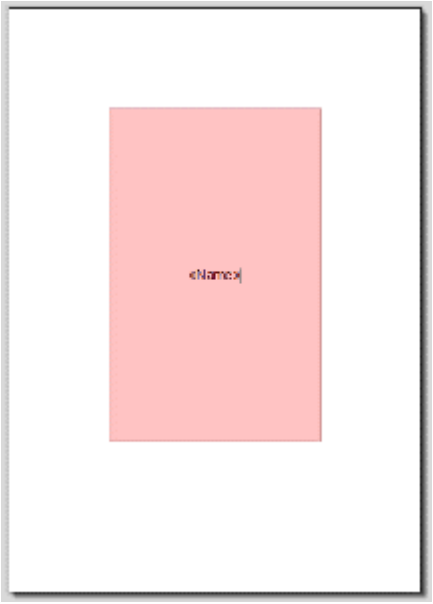
You can save and delete labels from the predefined list.



When you press OK one row of the table is inserted. Now you can add fields as usual.

Then you have to add the “NEXT” field after the last field in each cell except in the last column.

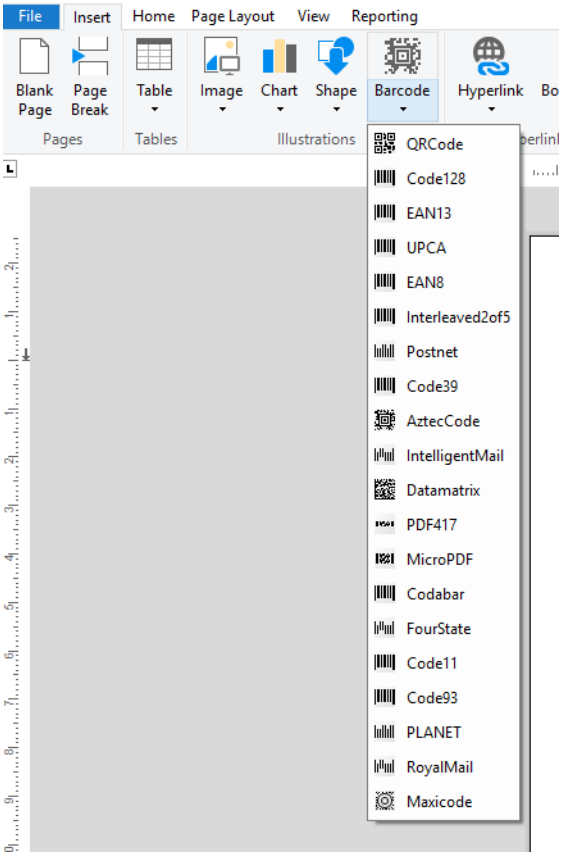
When choosing “Label printer” then a table is created with just one table cell fitting the whole page. In this case you should not use the “NEXT” field.



This will create a report that can be used for special label printers. Before creating this table, you should clear the report and select the correct paper-size.

Barcodes

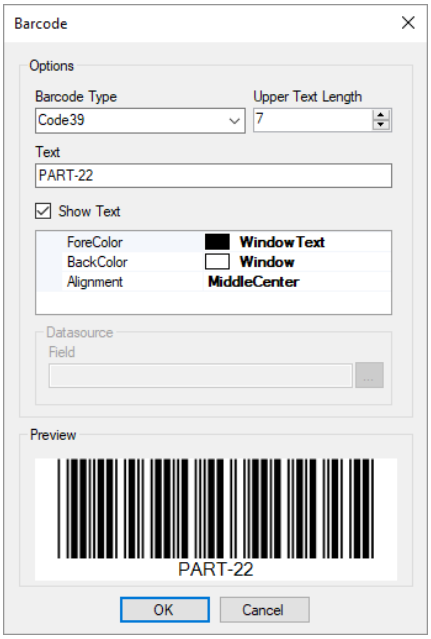
We now support barcodes. To insert a barcode, go to the tab Insert and select the barcode button.



Here you select the type of barcode to use. Double click on the barcode to get to the barcode properties page. Here you can connect the barcode to the database or set the text for a non-connected barcode. You can also change the type of the barcode as well as other settings.

Note! Every type of barcode has certain limitations. It can be a minimum and maximum length of the text to encode for example. If the data from the database is not valid for a certain barcode then the barcode will not be encoded correctly. So, it is important to format the data correctly for the chosen barcode.

Here is a video showing how to use barcodes both for fixed values and for barcodes connected to the report data:
BARCODES

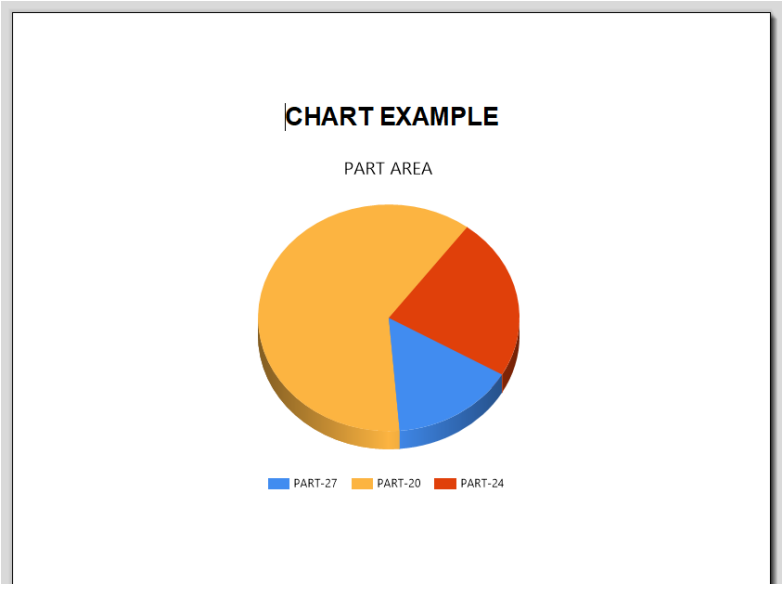


Barcode properties

PART-22	PART-22
PART-30	PART-30
PART-32	PART-32
PART-28	PART-28
PART-31	PART-31
PART-18	PART-18
PART-27	PART-27

Charts

It is possible to create charts that are driven by the data from IGEMS.
First you insert a chart.
Then select the chart and go to the “Chart layout” tab.
Here you select “Set data relation” and select the data.



See this video for how to create this report:
Chart example video

Script

The report can be extended and modified using the report script. The script is connected to the report and is executed before the report is generated. So, this is the place to modify/extend the data that can be used in the report. This is also a good place if you need to export data to another system using for example XML.
There are a number of LISP functions that can be used. Note that all rows have a zero-based index, this means that the first row has index 0, the second row index 1 etc. All tables and columns are accessed using strings representing the name of the tables and columns. To edit the script, select the “Script” menu item. A new editor will open where you can edit the script. The script is saved with the template.

LISP functions

Here is a list of special report LISP functions.

(REP-GETTABLES)

Returns a list of all tables in the report database.

(REP-GETCOLUMNS <table string>)

Returns a list of all columns in a table.

(REP-GETCELL <table string> <column string> <row int>)

Returns the value in a cell. Row starts with 0 (zero-based).

(REP-ROWCOUNT <table string>)

Returns the number of rows in a table.

(REP-ADDTABLE <table string>)

Creates a new table to the report database.

(REP-ADDCOLUMN <table string> <column string> <value object> <description string>)
Adds a new column to a table. The object value decides the type of the columns and is also the default value for all new rows added.

(REP-ADDROW <table string>)
Adds a new row to a table. After adding a row, you need to call REP-SETCELL for each column to set the values of the cells.

(REP-SETCELL <table string> <column string> <row int> <value object>)
Sets the value of a cell.

(REP-SETUNIT <table string> <column string> <unit string>)
Sets the unit of a column.

(REP-SETDECIMALS <table string> <column string> <decimals int>)
Sets the number of decimals of a column.

(REP-SAVEXML <filename string>)
Saves the database to an XML file. If the file exists it is overwritten. If does not exist it is created.

(REP-DATE [(year,month,day)])
Returns a date object that can be used in the reports.
If the optional list of year,month,day is not specified the todays date is returned.
Example:

```
(REP-DATE (LIST 2018 8 14))
```

(REP-TIME <seconds >)
Returns a time object that can be used as a value in the reports.

(REP-ENTS)
Returns the list of entities that the user selected when running the report. This list is only valid for reports that are created in APPS.

(REP-AUTOSAVE)
Autosaves the report. Only works if a result file has been set.

(REP-AUTOPRINT)
Prints the report.

(REP-SETRESFILE <filename string>)
Sets the result filename.

Sample scripts

Below are some sample scripts showing some basic things you can do with the report script system.

Modify an existing value

```
; Sample modifying an existing field in the database
; Adding 10.0 to CCostTotal in table PartPP
(SETQ rows (REP-ROWCOUNT "PartPP"))
(SETQ idx 0)
(WHILE (< idx rows)
  (SETQ cost (REP-GETCELL "PartPP" "CCostTotal" idx))
  (SETQ cost (+ cost 10))

  (REP-SETCELL "PartPP" "CCostTotal" idx cost
  (SETQ idx (+ idx 1))
)
```

Adding a new column to an existing table and set the value

```
; Sample adding a column to an existing table and setting its value
; Adding column "Color" to table "Parts" and set it to "RED" as default
; Then we loop all rows and set every second part to "YELLOW"
(REP-ADDCOLUMN "Parts" "Color" "RED" "The color of the part")
(SETQ rows (REP-ROWCOUNT "Parts"))
(SETQ idx 0)
(while (< idx rows)
  (REP-SETCELL "Parts" "Color" idx "YELLOW")
  (SETQ idx (+ idx 2))
)
```

Adding a new table

```
; Sample adding a custom table to the report
; Adding a Countries table and fill it in with some values
(REP-ADDTABLE "Countries")
(REP-ADDCOLUMN "Countries" "Name" "" "The name of the country")
(REP-ADDCOLUMN "Countries" "Code" "" "The country code")
(REP-ADDROW "Countries")
(REP-SETCELL "Countries" "Name" 0 "Sweden")
(REP-SETCELL "Countries" "Code" 0 "SE")
(REP-ADDROW "Countries")
(REP-SETCELL "Countries" "Name" 1 "United states")
(REP-SETCELL "Countries" "Code" 1 "US")
(REP-ADDROW "Countries")
(REP-SETCELL "Countries" "Name" 2 "France")
(REP-SETCELL "Countries" "Code" 2 "FR")
```

Setting the column format

```
; Sample adding a column to an existing table and setting its unit, decimals and value

; Adding column "Volume" to table "Parts"

(REP-ADDCOLUMN "Parts" "Volume" 0.0 "The volume of the part")
(REP-SETDECIMALS "Parts" "Volume" 4)
```

```
(REP-SETUNIT "Parts" "Volume" "m³")
(SETQ rows (REP-ROWCOUNT "Parts"))
(SETQ thickness (REP-GETCELL "Material" "Thickness" 0)) ; Thickness is in mm
(SETQ thickness (* thickness 1e-3)) ; Convert thickness to meter
(SETQ idx 0)
(WHILE (< idx rows)
  (SETQ area (REP-GETCELL "Parts" "Area" idx)) ; Area is in m2
  (SETQ volume (* area thickness))
  (REP-SETCELL "Parts" "Volume" idx volume)
  (SETQ idx (+ idx 1))
)
```

Exporting to XML

```
(REP-SAVEXML "c:\\temp\\report.xml")
```

Application reports

It is possible to create custom reports from the APP system.
Just create an APP and call this function:

(**REPORT-CREATE** <entities> <template string> [resultfile string] [autosave bool] [autoprint bool] [silentmode bool])

The template must end with .TX. If this file does not exist it is created.
The database will be populated with the Report, Machine, Material, Parts, Organizer and Sheets data. No JOB info or COST info will be available. If you need this data you should make a custom template in the relevant report instead.
When making a report from the APPS you also has access to the (REP-ENTS) function so that you can customize the database with data not only from parts and sheets.

The normal workflow here is:

1. Create an APP and call the REPORT-CREATE function with a template file.
2. Then run the APP and an empty template will be created
3. Edit the template and save.
4. Then you probably want to edit the template script to do customization to the database.
5. Edit the template again if needed.
6. Done!

Sample: Coming soon…

Other postprocessor functions

(HMZ <2D-point> [<to-point>])

The function will return a list with X, Y and Z coordinates and a tool vector.

(HMZ (LIST 100 100)) returns ((100 100 2.0) (0 0 -1))

If you enter two points than you will have a list of list of points and vectors

(HMZ (LIST x y) (LIST x y)) returns (((x y z)(xv yv zv)) ((x y z) (xv yv zv)) ((x y z) (xv yv zv)))

The accuracy number of points are depending of the accuracy of the height map.

(HMZARC <startpoint> <midpoint> <endpoint> <acc>)

The function will take the information from a circular movement and returns a list of X,Y and Z coordinates and a tool vector. The accuracy is always in metric.

(HMZARC <startp> <midp> <endp> 0.1) returns (((x y z)(xv yv zv)) ((x y z) (xv yv zv)) ((x y z) (xv yv zv)))

(CIRCULARPIERCINGTIME)

This function will calculate the circular piercing time by using a formula based on material properties and cutting parameters.
(STATIONARYPIERCINGTIME)
This function will calculate the circular piercing time by using a formula based on material properties and cutting parameters.
(LINEARPIERCINGDISTANCE)
This function will calculate the circular piercing time by using a formula based on material properties and cutting parameters.
(CIRCULARPIERCINGDIAMETER)
This function will calculate the circular piercing time by using a formula based on material properties and cutting parameters.
(CIRCULARPIERCINGSPEED)
This function will calculate the circular piercing time by using a formula based on material properties and cutting parameters.

Interfacing ILIPS with a .NET language

A brief introduction to interfacing ILISP with a .NET language

It is possible to call a function written in a .NET language from ILISP. This is done by giving a function the attribute: LispSharp("LISPNAME"), where lispname is the function name from lisp.

The following steps are needed to create a complete lisp function in C#:

1. Create a new project for a class library assembly in Visual Studio
2. Create a public static class, containing a public static function decorated with the LispSharp attribute
3. Implement the function as needed and return a .NET value casted to an object:

null is used to return nil

double are used to return floating point numbers

TypeT.T is used to return T (true Booleans are not used and does not exist in lisp)

Any other object can be returned as wished, but for example float won't be recognized as a floating point number in the lisp engine

4. In a lisp app, do (LOAD "mylispdll.dll") to load the assembly IGEMS, where after the function(s) is available

Here is an implementaion of function MULT that multiplies two numbers in c#:

```
[LispSharp("MULT")]
public static object MyMultFunc(LispEngine L, Cons args)
{
  double a = 0.0, b = 0.0;
  L.GetNumberArg(ref args, ref a);   // fetch first argument
  L.GetNumberArg(ref args, ref b);   // fetch second argument
  L.CheckArgSentinel(args);  // throw an error if there are more arguments
  return (object)(a * b);
}
```

The class LispEngine has many utility functions for managing lisp lists as well as fetching arguments etc.

The most important ones, normally needed, is the Get...Arg(ref args, ref obj)

The class Cons is a standard LISP S-Expression, containing a CAR and a CDR as specified in any lisp internals documentation.

The object pointed to by CAR is in the ILISP case a general .NET object.

OEM-Labeling of IGEMS

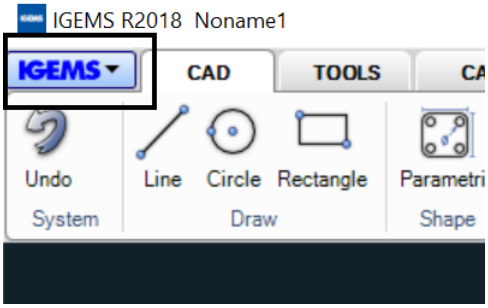
You can change the look of IGEMS by modify or adding following files to the C:/Program/IGEMS_R2018/RES directory:

SPLASH.PNG

If this file exists then it will be shown when you start IGEMS. It will be shown 2 seconds while the program load into the memory.

SYSBUTTON.PNG

This file replaces the standard system button design.

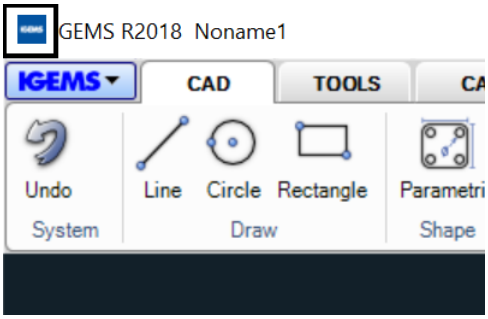


I good size of this file may be approximately 64 x 15 pixels

.

SYSICON.ICO

This file replaces the standard system icon at the upper left corner.



PROGNAME.TXT

This file should only contain one line. This line will be at the title line.