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Inertial Measurement System for Kinematic Control

CAN Interface for iNav 32

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1 File Definition of the CAN-Interface

If the system is to be operated via the NAV_Command software, the operator does not need to read this documentation.

If the IMS is to send data via CAN after power-up without additional commands via the XIO interface, this document must be read by the operator.

The CAN-Module of the navigator needs a CAN definition file (*.CAN) to define the CAN-IDs and to correlate the navigatior data to the CAN-IDs. This file must be located in the folder 'CAN' of the IMS file system and the name of the file must be given in the navigator CAN configuration (for instructions how to do this and to set other configuration values like the baudrate of the CAN interface, see the CAN section of the NavCommand documentation – in short words: copy the file *.CAN into the upd-folder of the IMS and re-boot the IMS). In the following the syntax of the definition file is given.

Syntax (case insensitive):

```
<ID> <f> <Name> [<OptList>]

<ID> :=          Base CAN-identifier (hex)
                 Data output will start on CAN identifier <ID>; if
                 data contains more the 8 bytes, this data will be
                 on <ID> + 1, <ID> + 2, ...
                 Range: 0x001...0x800 for standard address range
                 and 0x0001...0xFFFF for extended address range
<f> :=           Output frequency in Hz, 0.0 = remote frame or
                 triggered (see <SyncOption>)
<Name>:=         Navigator/XIO-Name of datas (xxx for DAT_ID_xxx,
                 i.e. RACC for DAT_ID_RACC)
<OptList> :=     <OptList>, <Option> | <Option>
                 (all in this line are options, seperated by ',')
<Option> :=      <WidthOption> | <ScfOption> | <OffsetOption> |
                 <MaskOption> | <AkkumulOption> | <TriggerOption>

<WidthOption> :=     long | short | float | double
                     modifies the data width
                     long =    32 bit signed int for integers
                     double =  64 bit double for floating points
                     short =   16 bit signed int for integers
                     float =   32 bit double for floating points
<ScfOption> :=       (Scf[.<Index>]=<Value>
                     scale factor for integer output
                     output = (navigator data - off) / scf
                     if zero, output is floating point
                     see below (Index is zero based)
<OffsetOption>:=     Off[.<Index>]=<Value>
```

```
                    offset for integer output (Index is zero
                    based)
                    ignored for floating point
<MaskOption> :=     Mask=<Value>
                    <Value> is a hex number in the range 0x0000
                    to 0xFFFF, where each bit set selects the
                    corresponding component of the data
<AkkumulOption> :=  Akkumul or Accumul
                    not possible for remote frame
                    if set, the data will be averaged instaed of
                    using the actual sample (if the data
                    supports this); avarage length is given
                    through IMS sample frequency devided by the
                    output frequency <f>
<SyncOption> :=     PPTSync or PPTSyncOnce
                    not possible for remote frame
                    PPTSync : output data with every PPT (pulse
                              per time); output frequency <f>
                              must be set to zero
                    PPTSyncOnce :  start output with next PPT
                                   (pulse per time), output
                                   frequency <f> should be > 0.0
```

Scale factor and offset can be set on a per data base or on a per component base with the Scf.<Index> and Off.<Index> option. Index is the zero based index of the data components selected by the mask option.
Sample:
<Name> = NLLH (= longitude latitude height)
<MaskOption> = 0006 (this selects latitude and height)
Scf.0 = scale factor of latitude
Scf.1 = scale factor of height

The byte order of the data is Little Endian, the floating format is IEEE 754.
The default settings for not given options are:

```
Scf=0.0
Off=0.0
Mask=FFFF
```

Example of a file CAN output definition file (this file, located on the IMS file system, must have the extension *.CAN!):

```
200 0.  TIME
201 0.1 RACC Scf=0.01, Akkumul, Mask=0003
202 0.1 RACC Scf=0.01, Akkumul, Mask=0004
```

I.e. the output of TIME on CAN-ID 200 (decimal ID number) as remote-frame and output of acceleration raw data (x- and y-component) accumulated on identifier 201 and z-component on ID 202 all 10 seconds with Scale factor 0.01. Because RACC is

scaled in in m/s², the integer value is scaled then to b = RACC / 0.01; therefore one LSB is equal to 0.01 m/s² (resp. 0.01 m/s² leads to the value 1).

2 General Operation Principle of the CAN-Interface

On a free definable identifier commands can be sent to command the IMS. These commands have the following format:

```
Cmd (WORD)
Arg (variable type, exactly 6 Bytes today, fill up if necessary)
```

The implemented commands are: (see also 'NavCANTest.chm' help file)

```
Cmd=0: GETDAT, Get data from Navigator
Arg=DatID (WORD), CanID (WORD), Incr
DatID=ID of navigator datum, see NAVDAT.H, DAT_ID_xxx
CanID=CAN basic identifier
Incr=Increment value
All N components of the datum will be output on the identifiers
CanID, CanID+Incr, CanID+2*Incr, ... CanID+(N-1)*Incr as dou-
ble-value one single time.

Cmd=1: GETPAR, Read of navigator parameters
Arg=ParID (WORD), CanID (WORD), Incr
ParID=ID of parameters, see NAVPARAM.H, PAR_ID_xxx
CanID=CAN basic identifier
Incr=Increment value
All N components of the datum will be output on the identifiers
CanID, CanID+Incr, CanID+2*Incr, ... CanID+(N-1)*Incr as dou-
ble-value one single time.

Cmd=2: SETPAR, setting of internal navigator's parameters
Arg=ParID (WORD)
The parameter stored before with PARAM will be commanded.
Attention: It is (yet) not possible to check, whether all N
components of the parameter were stored before with PARAM.

Cmd=3: PARAM, Storing of parameter components
Arg=Indx (WORD), Value (float)
The component Indx of a parameter will be stored, to set the
parameter later completely.

Cmd=4: FA, Setting of sampling frequency
Arg=Val (WORD)
Val is the sampling frequency in Hz (> 0)

Cmd=5: BEGAL0, Start of standard alignment (XIO_CMD_BEGAL0)
Arg=-

Cmd=6: ENDAL0, End of standard alignment (XIO_CMD_ENDAL0)
Arg=-
```

Cmd=7: EXIT, End of program
Arg=Exit-Code (WORD, 0..255)
The program will be terminated with the given Exit-Code (corresponding to XIO_CMD_EXIT)

Cmd=8: RPY, command Eulerian angles
Arguments: Roll, Pitch, Yaw (16bit signed int). Scale factor = 180° x 2^{-15}, unit=rad

Cmd=9: LAT (float), command latitude
Arguments: Latitude (float), unit=rad

Cmd=0x0A: LAT (signed short int), command latitude.
Argument: Latitude (16/32 bit signed int),
Scale factor=90° x 2^{-15} / 90° x 2^{-31}

Cmd=0x0B: UPDT, Set update mask (XIO_CMD_UPDT)
Argument: update mask (WORD) + Flag (WORD, 0 or 1)

Cmd=0x0C: enable/disable sending of CAN frames [SEND]
Arguments: Flag (WORD), o=disable, 1=enable

CMD=0x0D: Define output frequency for the following CAN-Logs
Argument: FRQ (float), Frequency in Hz, default 0 Hz

CMD=0x0E: Define scale factor for the following CAN-Logs
Argument: SCF (float), Scale factor, default 0.0

CMD=0x0F: Define offset for the following CAN-Logs
Argument: OFF (float), Offset, default 0.0

CMD=0x10: Command a CAN-Log
Arguments: CAN-ID (WORD), Navigator-Datum-ID (WORD), MASK (WORD)
MASK defines, which components of the ID will be selected (0003 e.g. to select the 1st und 2nd component)

CMD=0x11: Install CAN-ID for Navigator-Status
Argument: CAN-ID (WORD); this ID can be installed once and cannot be changed again without IMU restart!.

CMD=0x12: send status
Argument: Status-Index (WORD),
Index, which defines, which status is selected. The status (DWORD-Bitmask,see XIO_CMD_STATUS) can be send only, if a CAN-ID for the Navigator Status is defined previously (with command CMD=0x12 or preset in configuration/Edit).

Cmd=0x13: set/reset accumulation [AKKUMUL] flag for CAN Log
Argument: Flag (WORD), 0=off, 1=on

Status Information:

The IMS can send status information on the "status ID" (ID defined in the system configuration) every time the status will change. For this the CAN message contains 6 byte:

Double Word	(4 Byte):	Status Content Information (status flag, low byte first)
Word	(2 Byte):	Index number of status (as defined in XIO, low byte first)

Example: If in the Status 5 (NMEA status) e.g. the height of GPS is valid, the double-word 0x00000020UL is transmitted followed by 0x00000010UL