File specifications

Version 4.5.1

Trademarks
All brand names and product names mentioned in this document are trademarks or registered trademarks of their respective companies/owners.

Note:
Designs and specifications are subject to change without notice.

Sweco Nederland B.V.
E-mail move3@sweco.nl
https://move3software.com

Contents

1.MOVE3 File Structures

In this document the structures of the MOVE3 input and output files are being described in full detail. The user can either create the input files using an ASCII text editor or let MOVE3 create the files using the integrated intelligent editors. A project is defined as a group of files containing all data necessary for the processing of a geodetic network containing surveyed data.

1.1.MOVE3 Input Files

All MOVE3 input files are standard ASCII files. They may be created and modified using any ASCII text editor. However, it is safer and more convenient to use the intelligent built-in editors of the Windows user interface. Files, which have the file name in common, are part of the same project. A project is defined, as a group of files comprising all data needed to process a network. Files in a project share the same file name, but have different extensions:

project.prj:	contains project dependent parameters, such as geometry, adjustment and testing parameters and print switches;
project.tco:	contains terrestrial coordinates, i.e. the coordinates of the terrestrial network in a map projection or in ellipsoidal coordinates;
project.gco:	contains GNSS coordinates, either cartesian, or ellipsoidal, or in a map projection;
project.geo:	contains the computed geoid heights of the stations;
project.obs:	contains all observations.

In previous versions of MOVE3 the observations were stored in two files. A *.tob* for the terrestrial observations and a *.gob* file for the GNSS observations. As from MOVE3 version 3.0 all observations will be stored in one observation file *.obs*.

MOVE3 versions 3.0 and later can read projects containing *.tob*- en *.gob*-files. MOVE3 version 3.0 and later projects cannot be used in older MOVE3 versions.

File types are identified by the file extensions ('prj', 'tco', 'gco', 'geo', 'obs' and also 'tob' and 'gob'). Other file extensions are not recognised by MOVE3.
The input files are subdivided into a number of blocks. The blocks are separated by a block separator: a record beginning with the $-symbol. This is also necessary in case the block is empty. The user is free to add comment to the record after the $-symbol. The first 4 records or lines of all ASCII input files are reserved for the file header comprising two blocks:

- the first block contains information on the MOVE3 version and the file type;
- the second block contains the network name (maximum 30 characters).

For instance:

MOVE3 V4.5.1 PRJ file

$

Kamerik

$

This is the file header from the project file of Kamerik, created by MOVE3 version 4.5.1. Based on the network name, the name of this project file could e.g. be 'kamerik.prj'. Other files in the project would then be called: 'kamerik.tco', 'kamerik.obs' and so on.
In addition to the presence of a file header, the following additional conventions apply with respect to the contents of MOVE3 input files:

- Fields in a record are not bound to a specific position, provided they are separated by at least two spaces. The order of fields within a record is fixed. The maximum record length is 255 characters.
- There are 16 positions available for station names. Any ASCII symbol may be included in the station name. However, the station name may not include two successive spaces since spaces are regarded as field separators.
- MOVE3 will *not* supply default values for standard deviations, which are defined as 0.0 in the input files.
- Files must end with a block separator ($-record).

The MOVE3 installer software copies input files of the 'Kamerik' demonstration project to your PC.

1.1.1.Project file (PRJ)

All parameters of the *Options* menu are gathered in the project or PRJ file. The standard file header is followed by 7 parameter blocks:

- Block 1 (Included File types) holds information on coordinate and observation file types included in the project.
- Block 2 (Geometry Parameters) holds information on the dimension of the solution, the map projection and the reference ellipsoid.
- Block 3 (Adjustment Parameters) holds parameters with information on the adjustment, e.g. phase, maximum number of iterations and break-off criterion of the iteration process.
- Block 4 (Precision and Testing Parameters) holds the parameters for precision and statistical testing.
- Block 5 (Default Standard Deviations) holds the default absolute and relative standard deviations for observations and known stations.
- Block 6 (Additional Parameters) holds information on additional unknowns: scale factors, vertical refraction coefficients, azimuth offsets and GNSS transformation parameters.
- Block 7 (Print Output Switches) holds information on which parts of the input, adjustment, precision and testing results are to be appended to the OUT logfile also known as MOVE3 output report.

In the following tables a complete description is included of the parameters including their default values and ranges.

- The following conventions apply:
- 'float' represents floating (= double precision) point numbers;
- 'char' represents characters;
- 'int' represents integers;
- 'dms' represents degrees minutes seconds (separated by one space);
- curly brackets '{}' are used to indicate a range of values;
- the parameters and the attached values may both be in uppercase or lowercase.

```
MOVE3 V4.5.1  PRJ file
$
<Project name>
```

$ Block 1: INCLUDED FILE TYPES			
Parameter	**Type**	**Default**	**Values**
TerCoord (toggle for TCO file)	char	YES	YES NO
GPSCoord (toggle for GCO file)	char	YES	YES NO
TerObserv (toggle for terrestrial observations in OBS file)	char	YES	YES NO
GPSObserv (toggle for GNSS observations in OBS file)	char	YES	YES NO
GeoidModel (toggle for usage of file with file extension *.geo)	char	NO	NO YES (= Automatic) GEOIDNLGEO2018GRS80 GEOIDNLGEO2008BESSEL GEOIDNLGEO2008GRS80 GEOIDNLGEO2004BESSEL GEOIDNLGEO2004GRS80 GEOIDHBG18INTERNATIONAL GEOIDHBG18GRS80 GEOIDHBG03INTERNATIONAL GEOIDHBG03GRS80 GEOID18 GEOID12 GEOID09 GEOID03 GEOID99 GEOIDCGG2013A GEOIDCANADA GEOIDAUSGEOID2020 GEOIDAUSGEOID09 GEOIDAUSGEOID98 GEOIDNZGEOID09 GEOIDFIN2005 GEOIDFIN2000 GEOIDLV98 GEOIDSGEOID09 GEOIDPT08 GEOIDEGM08REDNAP GEOIDITG2009 GEOIDOSGM15UK GEOIDOSGM02UK GEOIDOSGM15NI GEOIDOSGM02NI GEOIDOSGM15ROI GEOIDOSGM02ROI GEOIDSWEN17_RH2000 GEOIDSWEN17_RH70 GEOIDSWEN08_RH2000 GEOIDSWEN08_RH70 GEOIDGUM97 GEOIDMYGEOID GEOIDEGM2008 GEOIDEGM96
FeatureCode (type of feature code used)	char	NONE	NONE LKI USER
ProjectHeight (only in UI displayed if the UI language is English)	float	0	any double precision value
ProjectType	char	DEFAULT	DEFAULT KADASTER AUSTRALIA_SP1

$ Block 2: GEOMETRY PARAMETERS			
Parameter	**Type**	**Default**	**Values**
Dimension (dimension solution)	int	3	1 (levelling orthom. height = 1D) 2 (horizontal position only = 2D) 3 (1D + 2D = 3D)
Projection (map projection)	char	NONE	NONE RD RDNAPTRANS2018 RDNAPTRANS LAMBERT72 LAMBERT72CORR LAMBERT2008 GAUSS_KRUGER UTM_NORTH UTM_SOUTH LOCAL TM STEREOGRAPHIC LAMBERT1 LAMBERT2 BRSO MRSO SWISS OSGB36_OSTN15 OSGB36_OSTN02 IRISHGRID_OSTN15 OBLIQUEMERCATOR FLATEARTH
ProjName (user name for configured map projection)	char	depends on projection	<projection name>
LonOriginCM (longitude of origin/ central meridian)	dms	depends on projection	{0, 360 E}
LatOrigin (latitude of origin)	dms	depends on projection	{-90 S, 90 N}
StandPar1 (1st standard parallel for any Lambert projection)	dms	depends on projection	{-90 S, 90 N}
StandPar2 (2nd standard parallel for any Lambert projection)	dms	depends on projection	{-90 S, 90 N}
SkewAzimuth (for any RSO or oblique Mercator projection)	dms	depends on projection	{-360, 360}
ProjScaleFac (scale factor of projection)	float	depends on projection	> 0
FalseEasting (false Easting of projection in m)	float	depends on projection	any double precision value
FalseNorthing (false Northing of projection in m)	float	depends on projection	any double precision value
Ellipsoid (reference ellipsoid or spheroid)	char	to be specified	USER AIRY MODIFIED_AIRY AUSTRALIAN_NATIONAL BESSEL_1841 MODIFIED_BESSEL CLARKE_1866 CLARKE_1880 EVEREST MODIFIED_EVEREST FISHER_1960 MODIFIED_FISHER_1960 FISHER_1968 GRS_1967

$ Block 2: GEOMETRY PARAMETERS			
Parameter	**Type**	**Default**	**Values**
(continued *Ellipsoid*)	char	to be specified	GRS_1980 HELMERT_1906 HOUGH INTERNATIONAL KRASSOVSKY_1940 SOUTH_AMERICAN_1969 WGS72 WGS84 TIMBALAI_EVEREST IAG75 IUGG75
SemiMajAx (semi-major axis of reference ellipsoid in m)	float	to be specified	> 0
InvFlatt (inverse flattening of reference ellipsoid)	float	to be specified	> 0
TransProj	char	NONE	NONE RDNAPTRANS2018 RDNAPTRANS2008 RDNAPTRANS2004 LAMBERT72CORR LAMBERT2008
GPSCoordType (type of GNSS coordinates)	char	XYZ	XYZ (Cartesian coordinates) ELL (ellipsoidal or geodetic coordinates) ENH (map projection planar coordinates)

$ Block 3: ADJUSTMENT PARAMETERS			
Parameter	**Type**	**Default**	**Values**
AdjDesign (toggle for computation method)	char	ADJUST	ADJUST DESIGN
Phase (phase or adjustment type of configured computation method)	int	1	1 (Free network) 2 (Pseudo constrained) 3 (Weighted constrained) 4 (Absolute constrained)
InnerConstraint (configurable only when *Phase* equals 1 = Free network)	char	FALSE	FALSE TRUE TRUE_KNOWNS
AngleUnit (unit of angular measurements)	char	GON	GON DEG DMS
LinearUnit (unit of distances)	char float char	m 1.0 meters	maximum 3 characters > 0 METERS INTSURVEYFOOT USSURVEYFOOT
IterMax (maximum number of adjustment iterations)	int	3	> 0
Epsilon (break-off criterion iteration process in m)	float	0.0001	> 0.0
Delta (singularity criterion during adjustment computation) **Not available in user interface**	float	1.0e-006	> 0.0
CovMatrix (covariance matrix written to an additional output file)	char	NONE	NONE FULL ILLWERKE AMBERG_GRP5000 STATIONSUMMARY STATIONSUMMARYGRID FULLCSV DESIGNMATRIX ONRONDHEID
ApostVarFac (a posteriori variance factor) **Not available in user interface**	char	DONOT	DONOT ONFAIL ALWAYS
VarComponent (variance component) **Not available in user interface**	char	NONE	NONE TERGPS OBSTYPE INSTRUMENT
VarIterMax (maximum number of iteration of variance factor) **Not available in user interface**	int	5	≥ 0
VarEpsilon (break-off criterion iteration process of variance factor) **Not available in user interface**	float	0.0100	≥ 0.0
FilterFreeStations (filtering of uncontrolled observations, if set to TRUE)	char	FALSE	TRUE FALSE
EstAddTrf (setting for the use of additional transformation parameters)	char	FREENET	DONOT (Never add) FREENET (Add to free network) ALWAYS (Always add)
COGO3Computation (setting to exclude special cases from approximate coordinate computation) Not available in user interface	char	ALL	ALL NORESECTION NOINTERSECTION NOREINTERSECTION
BaseStation1 *BaseStation2* *BaseStation3* (these 3 options are applicable only when *Phase* equals 1 = Free network)	char		<name of base station 1> <name of base station 2> <name of base station 3>

$ Block 4: PRECISION AND TESTING PARAMETERS			
Parameter	**Type**	**Default**	**Values**
Sigma0 (square root of variance of unit weight)	float	1.0	> 0.0
Alfa0 (significance level W-test)	float	0.0010	0.0010 (1 ppm) 0.0100 (1%) 0.0500 (5%)
AlfaShiftVector (significance level W-test Shift Vector)	float	0.0010	0.0010 0.0100 0.0500 0.3170 0.5000
Beta (power of statistical test)	float	0.80	0.70 0.80 0.90
ConfidenceLevel1D (confidence level for 1D standard deviations)	float	0.683	0.683 (standard) 0.900 0.950 0.990
ConfidenceLevel2D (confidence level for 2D standard ellipses)	float	0.394	0.394 (standard) 0.900 0.950 0.990
C0 (C0 parameter criterion matrix in cm²)	float	0.000	≥ 0.0
C1 (C1 parameter criterion matrix in cm²/km)	float	1.000	≥ 0.0
DataSnooping (datasnooping off or on)	char	NO	NO YES
DataSnoopingFTestHigh (datasnooping stop criterion, upper F-test value)	float	2.000	≥ 0.0
DataSnoopingFTestLow (datasnooping stop criteria, lower F-test value)	float	0.500	≥ 0.0
DataSnoopingMaxRemovals (datasnooping stop criteria, maximum number of removed observations/known stations)	int	25	≥ 0
DataSnoopingMinRedundancy (datasnooping stop criteria, minimal redundancy of observation to be removed)	float	51.00	0-100%

$ Block 5: DEFAULT STANDARD DEVIATIONS			
Parameter	**Type**	**Default**	**Values**
SigmaAbsR (absolute standard deviation directions in AngleUnit)	float	0.00100 gon 0.00090 deg 0 0 03.24 dms	≥ 0.0
SigmaRelR (relative standard deviation directions in AngleUnit.km)	float	0.00000	≥ 0.0
SigmaAbsS (absolute standard deviation distances in m)	float	0.0100	≥ 0.0
SigmaRelS (relative standard deviation distances in ppm)	float	0.0	≥ 0.0
SigmaAbsZ (absolute standard deviation zenith angles in AngleUnit)	float	0.00100 gon 0.00090 deg 0 0 03.24 dms	≥ 0.0
SigmaRelZ (relative standard deviation zenith angles in AngleUnit.km)	float	0.00000	≥ 0.0
SigmaAbsA (absolute standard deviation azimuths in AngleUnit)	float	0.00100 gon 0.00090 deg 0 0 03.24 dms	≥ 0.0
SigmaRelA (relative standard deviation azimuths in AngleUnit.km)	float	0.00000	≥ 0.0
SigmaDHA (standard deviation height differences in mm)	float	0.00	≥ 0.0

$ Block 5: DEFAULT STANDARD DEVIATIONS (continued)			
Parameter	**Type**	**Default**	**Values**
SigmaDHB (relative standard deviation height differences in mm/√km)	float	1.00	≥ 0.0
SigmaDHC (relative standard deviation height differences in mm/km)	float	0.00	≥ 0.0
SigmaShiftVectorEN (standard deviation shift vector positions in m)	float	0.0100	≥ 0.0
SigmaShiftVectorH (standard deviation shift vector heights in m)	float	0.0100	≥ 0.0
SigmaLocalCoordEN (standard deviation local coordinate positions in m)	float	0.0100	≥ 0.0
SigmaLocalCoordH (standard deviation local coordinate heights in m)	float	0.0100	≥ 0.0
SigmaAbsDX (absolute standard deviation GNSS baselines in m)	float	0.0100	≥ 0.0
SigmaRelDX (relative standard deviation GNSS baselines in ppm)	float	1.0	≥ 0.0
SigmaAbsX (standard deviation observed GNSS coordinates in m)	float	0.0100	≥ 0.0
SigmaLatLon (standard deviation positions expressed in latitudes and longitudes in m)	float	0.0100	≥ 0.0
SigmaHgt (standard deviation heights in m)	float	0.01000	≥ 0.0
SigmaXYZ (standard deviation Cartesian coordinates in m)	float	0.0100	≥ 0.0
SigmaCentr (centring error in m)	float	0.0000	≥ 0.0
SigmaInstr (height of instrument error in m)	float	0.00000	≥ 0.0
SigmaTape (standard deviation for eccentric measurement in m)	float	0.0100	≥ 0.0
SigmaOrthogonal (standard deviations for determination of orthogonal projection in m)	float	0.0100	≥ 0.0
SigmaDistLine (standard deviation for geometrical relations with distances in m)	float	0.0150	≥ 0.0
SigmaAngle (standard deviation for geometric relations with angles in AngleUnit)	float	0.10000 gon 0.09000 deg 0 05 24 dms	≥ 0.0
SigmaIdealXY (precision of idealisation position in m)	float	0.0000	≥ 0.0
SigmaIdealH (precision of idealisation height in m)	float	0.0000	≥ 0.0
SigmaGeoidAbs (absolute precision of geoid model in m)	float	0.0000	≥ 0.0
SigmaGeoidRel (relative precision of geoid model in ppm)	float	0.0000	≥ 0.0

$ Block 6: ADDITIONAL PARAMETERS			
Parameter	**Type**	**Default**	**Values**
*ScaleFac**n*** (scale factor related to distance S***n***, where ***n*** € [0,9])	char float	FREE 1.0	FREE FIXED > 0.0
*VertRefr**n*** (vertical refraction coefficient related to zenith angle Z***n***, where ***n*** € [0,9])	char float	FIXED 0.13	FREE FIXED any double precision value
AzimOffsn (azimuth offset related to azimuth A***n*** in AngleUnit, where ***n*** € [0,9])	char float	FIXED 0.0	FREE FIXED depends on AngleUnit
GPSTrfTX (GNSS transformation parameter 1: translation X)	char float float	FREE 0.0 (value) 0.0 (sd ≥ 0.0)	FREE FIXED WEIGHTED any double precision value
GPSTrfTY (GNSS transformation parameter 2: translation Y)	char float float	FREE 0.0 (value) 0.0 (sd ≥ 0.0)	FREE FIXED WEIGHTED any double precision value
GPSTrfTZ (GNSS transformation parameter 3: translation Z)	char float float	FREE 0.0 (value) 0.0 (sd ≥ 0.0)	FREE FIXED WEIGHTED any double precision value
GPSTrfRX (GNSS transformation parameter 4: rotation X)	char float float	FREE 0.0 (value) 0.0 (sd ≥ 0.0)	FREE FIXED WEIGHTED any double precision value
GPSTrfRY (GNSS transformation parameter 5: rotation Y)	char float float	FREE 0.0 (value) 0.0 (sd ≥ 0.0)	FREE FIXED WEIGHTED any double precision value
GPSTrfRZ (GNSS transformation parameter 6: rotation Z)	char float float	FREE 0.0 (value) 0.0 (sd ≥ 0.0)	FREE FIXED WEIGHTED any double precision value
GPSTrfSc (GNSS transformation parameter 7: scale factor)	char float float	FREE 0.0 (value) 0.0 (sd ≥ 0.0)	FREE FIXED WEIGHTED (value ≥ 0.0)
GPSCGX (X Rotation Center for Molodensky method)	float	0.0	any double precision value
GPSCGY (Y Rotation Center for Molodensky method)	float	0.0	any double precision value
GPSCGZ (Z Rotation Center for Molodensky method)	float	0.0	any double precision value
LocalTrfType (type of similarity transformation for local coordinates)	char	NONE	NONE 1D 2D 3D 2D1D 2DNoScale 3DNoScale 2D1DNoScale

$ Block 7: PRINT OUTPUT SWITCHES			
Parameter	**Type**	**Default**	**Values**
PrProjConst (toggle for printing projection and ellipsoid constants in LogFile report)	char	YES	YES NO
PrInpCoords (toggle for printing input coordinates in LogFile report)	char	YES	YES NO
PrAddParms (toggle for printing input additional parameters in LogFile report)	char	YES	YES NO
PrInpObsv (toggle for printing input observations in LogFile report)	char	YES	YES NO
PrAdjCoords (toggle for printing computed adjusted coordinates in LogFile report)	char	YES	YES NO
PrExtReliab (toggle for computing and printing external reliability in LogFile report - hence set to NO means no computation)	char	NO	YES NO
PrAbsStandEll (toggle for printing computed absolute standard ellipses in LogFile report)	char	YES	YES NO
PrRelStandEll (toggle for printing computed relative standard ellipses in LogFile report)	char	YES	YES NO
PrTestCoords (toggle for printing computed test results of adjusted coordinates in LogFile report)	char	YES	YES NO
PrErrCoords (toggle for printing computed estimated errors for adjusted coordinates in LogFile report)	char	YES	YES NO
PrAdjParms (toggle for printing adjusted additional parameters in LogFile report)	char	YES	YES NO
PrAdjObsv (toggle for printing adjusted observations in LogFile report)	char	YES	YES NO
PrTestObsv (toggle for printing test results for observations in LogFile report)	char	YES	YES NO
PrErrObsv (toggle for printing estimated errors for adjusted observations in LogFile report)	char	YES	YES NO
LogFile (report file format)	char	XML	ASCII XML HTML

$ End of file

The following 7 input parameters cannot be changed through the user interface, i.e. only configurable via manual editing the ASCII project file (*.prj):

- **Delta**
- **ApostVarFac**
- **VarComponent**
- **VarIterMax**
- **VarEpsilon**
- **COGO3Computation**
- **Sigma0**

1.1.2.Terrestrial coordinates file (TCO)

The TCO file is the input file containing the coordinates of the terrestrial network expressed either by plane coordinates in a map projection (X East, Y North, planar height) or by geodetic coordinates (latitude, longitude, ellipsoidal height). The file may comprise both known and approximate coordinates. A coordinate is marked as a known coordinate by an asterisk * directly behind the pertaining coordinate. Alternatively, an asterisk * on the first position of the record indicates that all three coordinates are known. A record is deselected by a number sign # on the first position of the record.

If a number sign # is placed directly behind a coordinate, the coordinate is known, but it will not be used as a known station in the computations. These deselected known coordinates will not be updated after a COGO3 computation (= computation of approximate coordinates).

The file must contain the PROJECTION parameter identifying the map projection. In case the file contains geodetic coordinates the PROJECTION parameter must be set to NONE. The value of this parameter must be identical to the value of the associated parameter *Projection* in Block 2 of the PRJ file.

Parameter : PROJECTION
Values : see paragraph 1.1, MOVE3 Input Files, under
Project file (PRJ)

For future use:

If the coordinates are not specified in meters the file must contain the LINEARUNIT parameter. The LINEARUNIT parameter is the conversion factor to meters.

Parameter : *LINEARUNIT*
Values : > 0.0

In case the international survey foot is used the LINEARUNIT parameter reads:

LINEARUNIT 0.3048

In case RD coordinates are used the PROJECTION parameter reads:

PROJECTION RD

In the general case where a projection is defined, coordinate records contain the following successive fields:

[#]:	optional deselection flag
[*]:	optional fix flag
station name:	maximum 16 characters
X East[*] or [#]:	in LINEARUNIT
Y North[*] or [#]:	in LINEARUNIT
height[*] or [#]:	in LINEARUNIT
standard deviation X East:	in LINEARUNIT
standard deviation Y North:	in LINEARUNIT
standard deviation height:	in LINEARUNIT
ID idealisation precision (printed only when different from zero):	'IP'
idealisation precision XY (printed only when different from zero):	in LINEARUNIT
idealisation precision H (printed only when different from zero):	in LINEARUNIT

In case the TCO file contains geodetic coordinates the PROJECTION parameter reads:

PROJECTION NONE

Coordinate records then contain the following successive fields:

[#]:	optional deselection flag
[*]:	optional fix flag
station name:	maximum 16 characters

latitude[*] or [#]:	in degrees minutes seconds
longitude[*] or [#]:	in degrees minutes seconds
height[*] or [#]:	in LINEARUNIT
standard deviation latitude:	in LINEARUNIT
standard deviation longitude:	in LINEARUNIT
standard deviation height:	in LINEARUNIT
ID idealisation precision (printed only when different from zero):	'IP'
idealisation precision XY (printed only when different from zero):	in LINEARUNIT
idealisation precision H (printed only when different from zero):	in LINEARUNIT

The flags, # and *, are optional as indicated by the square brackets [ ]. Standard deviations need only be specified for known stations.

Latitudes and longitudes are in degrees, minutes and seconds, and must be separated by *one* (and only one) space.

Latitudes range from -90 S to +90 N degrees, longitudes range from 0 to +360 E degrees.

Example file for Kamerik sample project:

```
MOVE3 V4.5.1 TCO file
$
Kamerik
$
PROJECTION RD
$
    Zwaan                122424.3440*       462944.3480*          0.0000*
    OC&L                 121650.3670*       462232.8160*         -0.8540*
    Afslag               122441.6560*       462162.7510*         -0.0630*
    OudeHoeve            121627.0169        462941.2011          -0.7086
$
```

Imagine following screenshot to be added to the right of the above screenshot (as it didn't fit well):

```
0.0100          0.0100          0.0100
0.0100          0.0100          0.0100
0.0100          0.0100          0.0100
```

1.1.3.GNSS coordinates file (GCO)

The GCO file is the input file containing the coordinates of the GNSS stations either as Cartesian WGS'84 coordinates (X,Y,Z) or as geodetic WGS'84 coordinates (latitude, longitude, ellipsoidal height) or expressed in planar coordinates in a map projection (X East, Y North, planar height). The file may contain both known and approximate coordinates. A coordinate is marked as a known coordinate by an asterisk *, directly behind the pertaining coordinate. Alternatively, an asterisk * on the first position of the record indicates that the complete coordinate triplet is known. A record is deselected by a number sign # on the first position of the record.

If a number sign # is placed directly behind a coordinate, the coordinate is known, but it will not be used as a known station in the computations. These deselected known coordinates will not be updated after a COGO3 computation (= computation of approximate coordinates).

The file must contain the COORDINATES parameter which identifies the GNSS coordinate type (Cartesian, ellipsoidal, map projection). The value of this parameter must be equal to the value of the associated parameter *GPSCoordType* in Block 2 of the PRJ file.

Parameter : *COORDINATES*
Values : *XYZ, ELL, ENH*

If the coordinates are not specified in meters the file also must contain the LINEARUNIT parameter. The LINEARUNIT parameter is the conversion factor to meters.

Parameter : *LINEARUNIT*
Values : > 0.0

If the coordinate type is XYZ, records contain the following successive fields:

[#]:	optional deselection flag
[*]:	optional fix flag
station name:	Maximum 16 characters
X[*] or [#]:	in LINEARUNIT
Y[*] or [#]:	in LINEARUNIT
Z[*] or [#]:	in LINEARUNIT

If the coordinate type is ELL, records contain the following successive fields:

[#]:	optional deselection flag
[*]:	optional fix flag
station name:	maximum 16 characters
latitude[*] or [#]:	in degrees minutes seconds
longitude[*] or [#]:	in degrees minutes seconds
height[*] or [#]:	in LINEARUNIT

If the coordinate type is ENH, records contain the following successive fields:

[#]:	optional deselection flag
[*]:	optional fix flag
station name:	maximum 16 characters
X East[*] or [#]:	in LINEARUNIT
Y North[*] or [#]:	in LINEARUNIT
height[*] or [#]:	in LINEARUNIT

The flags, * and #, are optional as indicated by the square brackets [ ]. Standard deviations need only be specified for known stations.

Latitudes and longitudes are in degrees, minutes and seconds, and must be separated by *one* (and only one) space.

Latitudes range from -90 S to +90 N degrees, longitudes range from 0 to +360 E degrees.

Example file for Kamerik sample project:

```
MOVE3 V4.5.1 GCO file
$
KamerikEll
$
COORDINATES ELL
$
    Zwaan              52 09 16.91880      4 54 41.64360            0.0000
    OC&L               52 08 53.72776      4 54 01.17626           -0.8540
    Afslag             52 08 51.63043      4 54 42.82399           -0.0630
    OudeHoeve          52 09 16.64561      4 53 59.69752           -0.7086
$
```

1.1.4.Observation file (OBS)

The OBS file is the input file containing all observations (both terrestrial and GNSS). The file begins with the standard 4-record file header, followed by the ANGLEUNIT parameter identifying the unit of directions, zenith angles and azimuths. The value must be equal to the value of the associated parameter *AngleUnit* in Block 3 of the PRJ-file.

Parameter : *ANGLEUNIT*
Values : *GON, DEG, DMS*

If the observations are not specified in meters the file also must contain the LINEARUNIT parameter. The LINEARUNIT parameter is the conversion factor to meters.

Parameter : *LINEARUNIT*
Values : > 0.0

A record may include the following observation types:

Total station record (= TS)
A total station record contains a direction, distance and zenith angle or a combination of these 3 observation types. A total station record always starts with following fields:

total station ID:	TS
station name:	maximum 16 characters
target name:	maximum 16 characters
station instrument height:	in LINEARUNIT
target instrument height:	in LINEARUNIT

Station and target instrument heights **must always** be included in the total station record. If no instrument heights are used (e.g. in a 2D network), specify 0.0.

After these mandatory fields the individual observation types are included:

Direction (= R):

observation type:	R**n**
reading[#]:	in gon/deg/dms depending on ANGLEUNIT
absolute standard deviation:	in gon/deg/dms
relative standard deviation:	in gon.km/deg.km/dms.km

R**n**: n € [0,9] is related to total station direction series number

Distance (= S):

observation type:	S**n**
reading[#]:	in LINEARUNIT
absolute standard deviation:	in LINEARUNIT
relative standard deviation:	in ppm

S**n**: n € [0,9] is related to total station distance scale factor

Zenith angle (= Z):

observation type:	Z**n**
reading[#]:	in gon/deg/dms depending on ANGLEUNIT
absolute standard deviation:	in gon/deg/dms
relative standard deviation:	in gon.km/deg.km/dms.km

Z**n**: n € [0,9] is related to total station vertical refraction coefficient number

A total station record may also contain following fields:

dimension ID:	1D / 2D / 3D
eccentricity ID Forward / Backward:	FB
reading Forward(-) / Backward (+):	in LINEARUNIT
eccentricity ID Left / Right:	LR
reading Left (-) / Right (+):	in LINEARUNIT
height to be solved for the instrument	IHGT0 to IHGT9

The direction series (R0...R9) have <u>no</u> **relationship with scale factors (S0...S9) and refraction coefficients (Z0...Z9). For example: a total station record can consist of R1, S0 and Z0.**

Azimuth record (= AZ):

azimuth ID:	AZ
station name:	maximum 16 characters
target name:	maximum 16 characters
station instrument height:	in LINEARUNIT

target instrument height: in LINEARUNIT
observation type: A**n**
reading[#]: in gon/deg/dms depending on ANGLEUNIT
absolute standard deviation: in gon/deg/dms
relative standard deviation: in gon.km/deg.km/dms.km

A**n**: n € [0,9] is related to azimuth offset number

Station and target instrument heights must *always* be included in the record. If no instrument heights are used (e.g. in a 2D network), specify 0.0.

Height difference (= DH):
height difference ID: DH
station name: maximum 16 characters
target name: maximum 16 characters
reading[#]: in LINEARUNIT
length levelling line: in LINEARUNIT
absolute standard deviation A: in mm
relative standard deviation B: in mm/√km
relative standard deviation C: in mm/km

The length of the levelling line followed during the measurement of a height difference must be included. If this length is specified as 0.0, MOVE3 will compute this length using the approximate coordinates.

GNSS baseline (= DX):
GNSS baseline ID : DX
station name : maximum 16 characters
target name : maximum 16 characters
DX[#]: in LINEARUNIT
DY[#] : in LINEARUNIT
DZ[#] : in LINEARUNIT

The precision is given either by the following 8 parameters:
standard deviation DX: in LINEARUNIT
Correlation DXDY: correlation coefficient
standard deviation DY: in LINEARUNIT
Correlation DXDZ: correlation coefficient
Correlation DYDZ: correlation coefficient
standard deviation DZ: in LINEARUNIT
multiplication factor ID: M0
multiplication factor: any positive value

or alternatively by the following 3 parameters:
standard deviation absolute: in LINEARUNIT
standard deviation relative: in ppm
dimension ID: 2D / 3D (default 3D)

Components of a GNSS baseline cannot be deselected individually. All components can be deselected by placing a number sign behind the DX, DY and DZ readings.

Observed GNSS coordinate (= X):
GNSS coordinate ID: X
station name: maximum 16 characters
X[#]: in LINEARUNIT
Y[#]: in LINEARUNIT
Z[#]: in LINEARUNIT
standard deviation X: in LINEARUNIT
standard deviation Y: in LINEARUNIT
standard deviation Z: in LINEARUNIT

Components of a GNSS coordinate cannot be deselected individually. All components can be deselected by placing a number sign behind the X, Y and Z readings.

Local coordinate (= LC):

Local coordinate ID:	LC
station name:	maximum 16 characters
E[#]:	in LINEARUNIT
standard deviation East:	in LINEARUNIT
N[#]:	in LINEARUNIT
standard deviation North:	in LINEARUNIT
H[#]:	in LINEARUNIT
standard deviation Height:	in LINEARUNIT

Shift vector (= SV):

Shift vector ID:	SV
station name:	maximum 16 characters
target name:	maximum 16 characters
DE[#]:	in LINEARUNIT
standard deviation DEast:	in LINEARUNIT
DN[#]:	in LINEARUNIT
standard deviation DNorth:	in LINEARUNIT
DH[#]:	in LINEARUNIT
standard deviation DHeight:	in LINEARUNIT

Geometrical relations (= GR)

All types of geometrical relations always start with the abbreviation GR.
The observation types, which are geometrical relations, contain following fields:

Angle (= AN)

name At station:	maximum 16 characters
name From station:	maximum 16 characters
name To station:	maximum 16 characters
observation type[#]:	AN
reading:	in gon/deg/dms depending on ANGLEUNIT
standard deviation:	in gon/deg/dms

Parallelism (= PA)

name station 1 (line 1):	maximum 16 characters
name station 2 (line 1):	maximum 16 characters
name station 3 (line 2):	maximum 16 characters
name station 4 (line 2):	maximum 16 characters
observation type[#] :	PA
standard deviation:	in gon/deg/dms depending on ANGLEUNIT

If the mutual distance between the lines has been measured, the record may also contain following fields:

observation type[#]:	LL
reading:	in LINEARUNIT
standard deviation:	in LINEARUNIT

Collinearity (= CL)

name At station:	maximum 16 characters
name From station:	maximum 16 characters
name To station:	maximum 16 characters
observation type [#]:	CL
standard deviation:	in LINEARUNIT

Distance point – line (= PL for point-line)

name At station:	maximum 16 characters
name From station:	maximum 16 characters
name To station:	maximum 16 characters
observation type[#]:	PL
Reading distance point to line:	in LINEARUNIT
standard deviation:	in LINEARUNIT

Perpendicular angle (= PD)

name At station:	maximum 16 characters
name From station:	maximum 16 characters
name To station:	maximum 16 characters

observation type[#]: PD
standard deviation: in gon/deg/dms depending on ANGLEUNIT

Perpendicular lines (= AL for alignment)
name station 1 (line 1): maximum 16 characters
name station 2 (line 1): maximum 16 characters
name station 3 (line 2): maximum 16 characters
name station 4 (line 2): maximum 16 characters
observation type[#] : AL
standard deviation: in gon/deg/dms depending on ANGLEUNIT

Chain and offset (= CH resp. PL)
name At station: maximum 16 characters
name From station: maximum 16 characters
name To station: maximum 16 characters
observation type[#]: CH
reading chainage: in LINEARUNIT
standard deviation: in LINEARUNIT
observation type[#]: PL
reading offset: in LINEARUNIT
standard deviation: in LINEARUNIT

Identical stations (= EQ for equality)
name From station: maximum 16 characters
name To station: maximum 16 characters
observation type[#]: EQ
dimension: 1D, 2D or 3D

Double distance (= DD)
name At station: maximum 16 characters
name From station: maximum 16 characters
name To station: maximum 16 characters
observation type[#]: DD
reading distance 1: in LINEARUNIT
standard deviation: in LINEARUNIT
observation type[#]: DD
reading distance 2: in LINEARUNIT
standard deviation: in LINEARUNIT
left right ID: LR
left right information: 0 = left, 1 = right

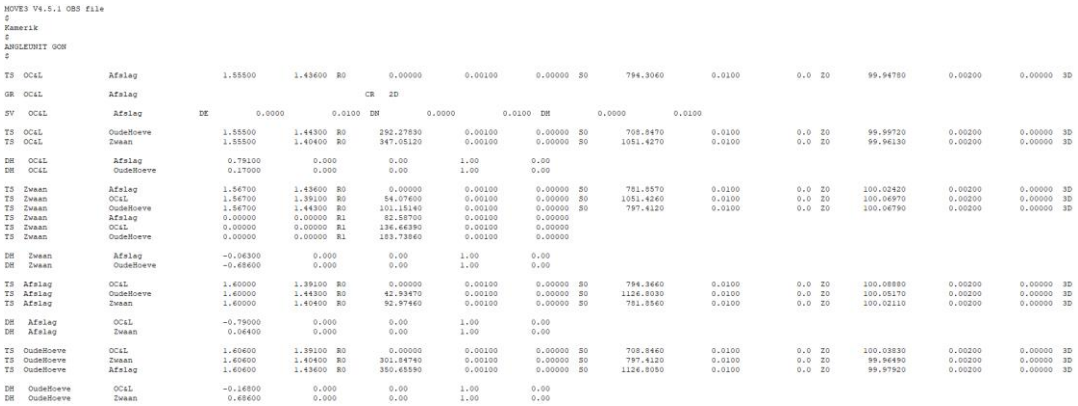
Tape distance (= TD)
name From station: maximum 16 characters
name To station: maximum 16 characters
observation type[#]: TD
reading tape distance: In LINEARUNIT
standard deviation: In LINEARUNIT

Circle radius (= CR)
name station at circle radius: maximum 16 characters
name station at circle origin/center: maximum 16 characters
observation type[#]: CR
Dimension (= fixed parameter): 2D

Contrary to other observation types the deselection symbol (#) for geometrical relation is placed directly behind the observation type. The reason for this is that some of the observation types (e.g. co linearity) do not contain a reading.

In case of a design computation the observation readings are read, but disregarded in the actual computation. A (dummy) value, e.g. 0.0 must be included.

Example file for Kamerik sample project:



```
MOVE3 V4.5.1 OBS file
$
Kamerik
$
ANGLEUNIT GON
$

TS  OC&L          Afslag          1.55500   1.43600  R0      0.00000     0.00100     0.00000  S0     794.3060     0.0100     0.0  Z0     99.94780     0.00200     0.00000  3D

GR  OC&L          Afslag                                CR   2D

SV  OC&L          Afslag        DE      0.0000      0.0100  DN      0.0000      0.0100  DH      0.0000      0.0100

TS  OC&L          OudeHoeve       1.55500   1.44300  R0    292.27830     0.00100     0.00000  S0     708.8470     0.0100     0.0  Z0     99.99720     0.00200     0.00000  3D
TS  OC&L          Zwaan           1.55500   1.40400  R0    347.05120     0.00100     0.00000  S0    1051.4270     0.0100     0.0  Z0     99.96130     0.00200     0.00000  3D

DH  OC&L          Afslag          0.79100     0.000        0.00        1.00        0.00
DH  OC&L          OudeHoeve       0.17000     0.000        0.00        1.00        0.00

TS  Zwaan         Afslag          1.56700   1.43600  R0      0.00000     0.00100     0.00000  S0     781.8570     0.0100     0.0  Z0    100.02420     0.00200     0.00000  3D
TS  Zwaan         OC&L            1.56700   1.39100  R0     54.07600     0.00100     0.00000  S0    1051.4260     0.0100     0.0  Z0    100.06970     0.00200     0.00000  3D
TS  Zwaan         OudeHoeve       1.56700   1.44300  R0    101.15140     0.00100     0.00000  S0     797.4120     0.0100     0.0  Z0    100.06790     0.00200     0.00000  3D
TS  Zwaan         Afslag          0.00000   0.00000  R1     82.58700     0.00100     0.00000
TS  Zwaan         OC&L            0.00000   0.00000  R1    136.66390     0.00100     0.00000
TS  Zwaan         OudeHoeve       0.00000   0.00000  R1    183.73860     0.00100     0.00000

DH  Zwaan         Afslag         -0.06300     0.000        0.00        1.00        0.00
DH  Zwaan         OudeHoeve      -0.65600     0.000        0.00        1.00        0.00

TS  Afslag        OC&L            1.60000   1.39100  R0      0.00000     0.00100     0.00000  S0     794.3660     0.0100     0.0  Z0    100.08880     0.00200     0.00000  3D
TS  Afslag        OudeHoeve       1.60000   1.44300  R0     42.93670     0.00100     0.00000  S0    1126.8030     0.0100     0.0  Z0    100.05170     0.00200     0.00000  3D
TS  Afslag        Zwaan           1.60000   1.40400  R0     92.97460     0.00100     0.00000  S0     781.8560     0.0100     0.0  Z0    100.02110     0.00200     0.00000  3D

DH  Afslag        OC&L           -0.79000     0.000        0.00        1.00        0.00
DH  Afslag        Zwaan           0.06400     0.000        0.00        1.00        0.00

TS  OudeHoeve     OC&L            1.60600   1.39100  R0      0.00000     0.00100     0.00000  S0     708.8460     0.0100     0.0  Z0    100.03830     0.00200     0.00000  3D
TS  OudeHoeve     Zwaan           1.60600   1.40400  R0    301.84740     0.00100     0.00000  S0     797.4120     0.0100     0.0  Z0     99.96490     0.00200     0.00000  3D
TS  OudeHoeve     Afslag          1.60600   1.43600  R0    350.65590     0.00100     0.00000  S0    1126.8050     0.0100     0.0  Z0     99.97920     0.00200     0.00000  3D

DH  OudeHoeve     OC&L           -0.16800     0.000        0.00        1.00        0.00
DH  OudeHoeve     Zwaan           0.68600     0.000        0.00        1.00        0.00
```

1.1.5.Geoid heights file (GEO)

The GEO file is the input file containing the geoid heights of the stations. The file begins with the standard 4-record header followed by the ELLIPSOID parameter. The value of this parameter must be equal to the associated parameter *Ellipsoid* in Block 2 of the PRJ file.

Parameter: *ELLIPSOID*
Values: see paragraph 1.1, MOVE3 Input Files, under
Project file (PRJ)

If the geoid heights are not specified in meters, this the file must also contain the LINEARUNIT parameter. The LINEARUNIT parameter is the conversion factor to meters.

Parameter: *LINEARUNIT*
Values: > 0.0

A record contains the following successive fields:

station name:	maximum 16 characters
geoid height:	in LINEARUNIT
deflection of the vertical East:	in arc seconds
deflection of the vertical North:	in arc seconds
deflection of the vertical fixed:	FIXED or FREE

The geoid height is the difference between the ellipsoidal height and the orthometric height, i.e. the height of the geoid above the reference ellipsoid or spheroid.

Example file for Kamerik sample project:

```
MOVE3 V4.5.1 GEO file
$
Kamerik
$
ELLIPSOID BESSEL_1841
$
Zwaan                    -0.0704          0.000          0.000  FIXED
OC&L                     -0.0702          0.000          0.000  FIXED
Afslag                   -0.0728          0.000          0.000  FIXED
OudeHoeve                -0.0680          0.000          0.000  FIXED
Collinear                -0.0699          0.000          0.000  FIXED
Identical                -0.0704          0.000          0.000  FIXED
OudeHoeve(2)             -0.0680          0.000          0.000  FIXED
IdenticalDist            -0.0707          0.000          0.000  FIXED
9999                     -0.0718          0.000          0.000  FIXED
$
```

1.2.MOVE3 Output Files

The MOVE3 design and adjustment module produces the following output files if the project file name is for instance *project.prj*:

project.cor	contains adjusted, known and approximate coordinates in case of a constrained adjustment (!= free network adjustment = *Phase* 1 hence this is available only when *Phase* € [2,3,4])
project.out1, project.out2	ASCII output report logfile containing an echo of the input and the results of the design or adjustment computation and testing results (*)
project.out1.xml, project.out2.xml	XML output report logfile containing an echo of the input and the results of the design or adjustment computation and testing results (*)
project.out1.html, project.out2.html	HTML output report logfile containing an echo of the input and the results of the design or adjustment computation and testing results (*)
project.err	contains warnings and error messages

(*) The number behind the text phrase out refers to the adjustment type or phase being either 1 (= free network) or 2 (one of 3 constrained adjustment types)

1.2.1.Computed coordinates file (COR)

In case of a constrained adjustment (pseudo, weighted or absolutely constrained) adjusted coordinates (first 3 columns: X East and Y North position and height coordinates) and computed standard deviations (last 3 columns for X East and Y North position and height coordinates) are directed to a separate coordinate file: the COR file (which stands for coordinate file). This file is e.g. input data to Sweco's software dg DIALOG BGT and can be used for analysis purposes in any other GIS related software.

This file output is configurable optionally via the menu "Compute" and submenu item "Adjustment…". Note that for Dutch Cadastre projects no COR file is being created as this output file is not desired for the 2000, 2000 coordinate system they work with.

By convention, the coordinate type of the adjusted coordinates in this file is equal to the coordinate type of the known stations. The COR file begins with the standard 4-record header, immediately followed by 4 parameter values identifying the map projection, ellipsoid, coordinate type and phase.

Parameter: *PROJECTION*
Values: see paragraph 1.1, MOVE3 Input Files, under **Projection**

Parameter: *ELLIPSOID*
Values: see paragraph 1.1, MOVE3 Input Files, under **Ellipsoid**

Parameter: *COORDINATES*
Values: *XYZ, ELL, ENH*

Parameter: *PHASE*
Values: *2, 3, 4*
see for an explanation paragraph 1.1, MOVE3 Input Files, under *Phase*

If the coordinates are not specified in meters the file also must contain the LINEARUNIT parameter. The LINEARUNIT parameter is the conversion factor to meters.

Parameter: *LINEARUNIT*
Values: > 0.0

The individual coordinates of a station are marked by an asterisk * in case the coordinate was entered as a known coordinate. A caret ^ is used for adjusted coordinates, for which the adjusted standard deviations are displayed too.
A coordinate is not marked when it was not computed in the adjustment, e.g. heights in a 2D adjustment. Such coordinates show approximate (and not adjusted!) coordinate values and do not contain adjusted standard deviations highlighted by ----.

Example:

```
MOVE3 V4.5.1 COR file
$
ARCADIS, Imagine the result
$
PROJECTION  RDNAPTRANS
ELLIPSOID   BESSEL_1841
COORDINATES ENH
PHASE       2
$
          VAL_0       106066.0579*       458832.9495*     18.5907^       0.0050       0.0050       0.0011
          557_0       106150.0000        458710.0000       4.1556*         ----         ----       0.0000
          650_0       106068.0405^       458718.7266^      5.8121^       0.0051       0.0051       0.0004
         1003_0       106051.9478^       458684.1545^      5.4086^       0.0051       0.0051       0.0006
         HI_8_0       106030.0000        458730.0000       5.4041^         ----         ----       0.0003
         HI_9_0       106060.0000        458710.0000       5.7597^         ----         ----       0.0002
    1001GPS_0         106002.6902^       458686.0061^      3.8732^       0.0051       0.0051       0.0015
$
```

1.2.2.MOVE3 output file (OUT1 or OUT2)

The results of the design or adjustment computation method and statistical testing of a project are written to the ASCII file with file extension *.out1 or *.out2. To achieve this output set the PRJ file parameter *LogFile* to ASCII.

1.2.3.MOVE3 XML output file (OUT1.XML or OUT2.XML)

The results of the design or adjustment computation method and statistical testing of a project are written to the XML formatted file with file extension *.out1.xml or *.out2.xml. To achieve this output set the PRJ file parameter *LogFile* to XML.

1.2.4.MOVE3 HTML output file (OUT1.HTML or OUT2.HTML)

The results of the design or adjustment computation method and statistical testing of a project are written to the HTML formatted file with file extension *.out1.html or *.out2.html. To achieve this output set the PRJ file parameter *LogFile* to HTML.

1.2.5.Error file (ERR)

The warning and error messages of COGO3, GEOID3, PRERUN3, LOOPS3 and MOVE3 are written to the project file with file extension *.err, for instance:

```
Warning: Tolerance exceeded: Station OudeHoeve.
Warning: No observations for station 9999.
```