Teqc: The toolkit

Teqc (pronouced "tek") is a simple yet powerful and unified approach to solving many pre-processing problems with GPS, GLONASS, and SBAS data:
translation: binary data reading/translation of native binary formats (optional RINEX file creation for OBS, NAV, and/or MET files or optional creation of BINEX)
editing and cut/splice: metadata extraction; editing, and/or correction of RINEX header metadata; or BINEX metadata records; as well as cutting/splicing of RINEX files or BINEX
quality check: quality checking of GPS and/or GLONASS data (native binary, BINEX, or RINEX OBS; with or without ephemerides)
These three main functions (from which teqc gets its name: translation, editing, and quality check) can be performed altogether, in pairs, or separately.

Translators (with varying limitations) are included in the current development for:

Trimble DAT, MES, ION, EPH download fileset
Trimble RT17 RS-232 real-time stream format (aka "binary cyclic print mode")
Trimble 4700, R7, 5700, NetRS BINEX
Trimble TSIP format (very limited)
Javad JPS format *1
Topcon TPS format *1
Ashtech "Version 3" B/E/S/D download fileset
Ashtech MBEN/PBEN and DBEN RS-232 real-time stream format
Ashtech Z-12 CGRS R-file format
Ashtech micro-Z BINEX
Ashtech micro-Z CGRS U-file format
AOA ConanBinary
AOA TurboBinary
Leica System 500 and 1200 MDB binary format
Leica System 500 and 1200 LB2 binary format
Leica MC1000/SR9600 LB2 binary format
Leica DS fileset format
Navcom binary format
u-blox UBX format
Canadian Marconi binary
Rockwell Zodiac binary
Motorola Oncore binary (limited: no phase)
Texas Instruments TI-4100 GESAR & BEPP/CORE formats
Texas Instruments TI-4100 ROM format
JPL Soc format
IGS RTigs format
ARGO .dat and .orb format

*1 If a set of TPS/JPS messages to be used is other than the default one or if the adopted order of messages in the default set of messages is changed in some way, make sure that the updated set of messages maintains the "epoch synchronization", i.e., the messages [~~] and [RD] precede the messages containing code, carrier phase and other types of measurements collected at the current epoch. Should the user violate this condition, he or she may not be able to correctly process corresponding raw data files with teqc or with Topcon's Pinnacle™ and other TPS post-processing software.

Teqc is designed to handle mixed satellite constellations, such as GPS, GLONASS, and SBAS; it is 100% non-interactive — to aid in using it with automatically executed scripts — with a command line interface.

Commands:

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Usage: teqc [opts] file1 [file2 [...]]
   or: teqc [opts] < stdin
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where [opts]:
  -id or +id           dump program id to stderr
  -help or +help       dump the entire on-line help to stderr
  +relax               allow relaxed requirements on RINEX header fields
  -relax               strict requirements on RINEX header fields (default)
  +reformat            allow reading of misformatted RINEX data fields
  -reformat            strict requirements on RINEX data fields (default)
  +err name            write stderr directly to file "name"
  ++err name           append stderr directly to file "name"
  +out name            write stdout directly to file "name"
  ++out name           append stdout directly to file "name"
  -config name         read file(s) "name" as configuration file(s)
  +config              dump all set parameters as a configuration to stdout
  ++config             dump all known parameters as a superset configuration
to stdout
  ++igs                dump all IGS receiver/antenna/dome designations to
stdout
  ++sym                dump all ASCII QC plot symbols to stdout
  -max_rx_ch[annels] # set maximum # of receiver channels based on receiver
type
                           (default for AOA = 12, Ashtech = 12, Trimble
= 12, TI-4100 = 4)
  -max_rx_SVs #        set maximum # of SVs trackable (per OBS epoch) based
on receiver type
                           (default for AOA = 12, Ashtech = 12, Trimble
= 12, TI-4100 = 4)
  -n_GPS #             set maximum expected GPS SV PRN to 0 < # < 256
(default = 32)
  -n_GLONASS #         set maximum expected GLONASS SV # to 0 < # < 256
(default = 24)
  -n_gssp #            set maximum expected GSSP SV # to 0 < # < 256
(default = 51)
  -n_Transit #         set maximum expected Transit SV # to 0 < # < 256
(default = 6)
  +ch                  use all channels (default)
  -ch#                 don't use channel #
  +NaN_obs             use all OBS data (default)
  -NaN_obs#            don't use SV w/ NaN data in list
  +G                   use all GPS SVs (default)
  -G#                  don't use GPS SV PRN #
  +R                   use all GLONASS SVs (default)
  -R#                  don't use GLONASS SV slot #
  +S                   use all GSSP SVs (default)
  -S#                  don't use GSSP SV slot #
  +T                   use all Transit SVs (default)
  -T#                  don't use Transit SV #
  -st[art_window] str  set start time to str ==
[[[[[[YY]YY]MM]DD]hh]mm]ss[.sssss]
  +dX #                delta X time of # from start time; X == Y, M, d, h,
m, s for year,...,second
  -dX #                delta X time of # from end time; X == Y, M, d, h, m,
s for year,...,second
  -e[nd_window] str    set end time to str ==
[[[[[[YY]YY]MM]DD]hh]mm]ss[.sssss]
  -hole name           read file "name" to establish list of window holes



  -delim#              change delimiter to # for seperating file names
(default = ,)
  +obs[file(s)] name   output any OBS records in binary input to file "name"
  +nav[file(s)] name   output any NAV records in binary input to file "name"
  +met[file(s)] name   output any MET records in input to file "name"
  +dump_i[on]          dump all ionosphere model parameters to stderr
  -dump_i[on]          don't dump ionosphere model parameters to stderr
(default)
  +dump_u[tc]          dump all UTC model parameters to stderr
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  -dump_u[tc]          don't dump UTC model parameters to stderr (default)
  +dump_u[tc]          dump parsing and other diagnostics to stderr
  -dump_u[tc]          don't dump parsing and other diagnostics to stderr
(default)
  -aoa code            input is from AOA (JPL) receiver, record type "code":
                         code = cb for ConanBinary survey data from
TurboRogue or TurboStar rxs
                         code = tb for TurboBinary survey data from
TurboRogue or TurboStar rxs
                         code = tbY for TurboBinary survey data from
Benchmark ACT rx ("Y-codeless")
  -ash[tech] code      input is from Ashtech receiver, record type "code":
                         code = d for download B* survey data
                         code = s for streamed RS-232 data
                         code = r for streamed R-file format data
                         code = u for streamed U-file format data
  -cmc code            input is from Canadian Marconi (CMC) receiver, record
type "code":
                         code = b for CMC binary

  -lei[ca] code        input is from Leica receiver, record type "code":
                         code = ds for Leica DS format
                         code = lb2 for Leica LB2 format
                         code = mdb for Leica MDB format
  -mot[orola] code     input is from Motorola receiver, record type "code":
                         code = oncore for Oncore binary
  -rock[well] code     input is from Rockwell receiver, record type "code":
                         code = z for Zodiac format
  -tr[imble] code      input is from Trimble receiver, record type "code":
                         code = d for download *.dat survey data
                         code = s for streamed RS-232 data
  -ti code             input is from Texas Instruments receiver, record type
"code":
                         code = gesar for TI-4100 GESAR & BEPP/CORE format
survey data
                         code = rom for TI-4100 TI-ROM format survey data
  -argo                input is ARGO format
  +P[codes]            expect and use P-codes (default)
  -P[codes]            don't expect P-codes
  +L2                  expect and use L2-carrier data (default)
  -L2                  don't expect L2-carrier data
  +L1_2                keep L1 cycle data if L1 is squared (default)
  -L1_2                turn off
  +L2_2                keep L2 cycle data if L2 is squared (default)
  -L2_2                turn off
  +CA_L1               use phase value in C/A code block as L1
  -CA_L1               use phase value in P1 code block as L1 (default)
  +msec_phs_adj        include adjustment to phase values at rx ms resets
  -msec_phs_adj        turn off (default)
  +leap[_seconds]      subtract current leap seconds from GLONASS
pseudoranges (default)
  -leap[_seconds]      turn off
  +rds                 reverse Doppler sign
  -rds                 turn off (default)
  +smooth[ing]         include smoothing correction to Ashtech pseudoranges
  -smooth[ing]         turn off (default)
  +Ashtech_qd          include all "questionable" data when translating
  -Ashtech_qd          exclude all "questionable" data (default)
  +Ashtech_B_file_adjust  Ashtech B-file is corrupted
  -Ashtech_B_file_adjust  normal Ashtech B-file (default)
  +Ashtech_old_clk_reset  use old Ashtech clock reset scheme
  -Ashtech_old_clk_reset  turn off (default)
  +lb2_fe              ignore Leica LB2 records until 0xfe record is read
  -lb2_fe              use all records (default)
  +geod_p              data from Trimble Geodesist-P receiver
  -geod_p              not from Geodesist-P (default)
  +TBnr                use 0x68 TurboBinary data (normal-rate observable
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record) (default)
  -TBnr                turn off
  +TBLC                use LC (0xde) TurboBinary data
  -TBLC                turn off (default)
  +TB1s                use 1-sec (0x1a) TurboBinary data)
  -TB1s                turn off (default)
  +TBhr                use high-rate (0xdb, 0xdc) TurboBinary data
  -TBhr                turn off (default)
  +TBfe_ff             recognize header/trailer records (0xff, 0xfe)
TurboBinary records (default)
  -TBfe_ff             ignore 0xff, 0xfe records
  +TB_ca_fix           apply CA offset fix to 0x68 TurboBinary records
(before ~1 Dec 92)
  -TB_ca_fix           turn off (default)
  +v[erify]            verify conformance to RINEX Version 2 standard
  -v[erify]            stream out RINEX Version 2 standard or other (such as
qc output) (default)
  -week #              initially set GPS week to # (for certain binary input
data streams) (default = best guess)
  +warn[ings]          dump any warnings to stderr (default)
  -warn[ings]          turn off
  +meta[data]          produce UNAVCO archive raw metadata table
  -meta[data]          turn off (default)
  +mds                 show short metadata summary
  -mds                 turn off (default)
  +mdf                 show probable format
  -mdf                 turn off (default)
  +phc                 output all RINEX post-header comments (default)
  -phc                 suppress RINEX post-header comments
  -base[year] #        change epoch base year to # A.D. (default = 1980)

  -O.{opt} arg(s)      override any existing OBS header {opt} with arg(s):
    -O.sum[mary] s           for OBS file(s) and input is not stdin, put
summary at beginning of output (two passes)
    -O.sum[mary] e           for OBS file(s), put summary at end of output
(requires only one pass)
    -O.an "str"              set OBS antenna number to "str"
    -O.at "str"              set OBS antenna type to "str"
    -O.px[WGS84xyz,m] x y z  set OBS antenna WGS 84 position to x y z (in
meters)
    -O.pg[eo,ddm] lat lon el set OBS antenna WGS 84 position to lat lon
elevation (degrees degrees meters)
    -O.pe[hEN,m] h E N       set OBS antenna position eccentricities to h E
N (in meters)
    -O.mov[ing] 1            force OBS antenna position to be in kinematic
(roving) state initially
    -O.ag[ency] "str"        set OBS operating agency to "str"
    +O.c[omment] "str"       append OBS comment "str"
    -O.dec[imate] #          modulo decimation of OBS epochs to # time units
                                    # = 30s results in epochs nominally at
00 and 30 seconds
    -O.def_wf i j            set OBS default wavelength factors to i and j
    -O.mod_wf i j n {SV1 SV2 ... SVn}  set OBS modified wavelength factors
to i and j of n SVs
    -O.e[nd] Y M D h m s     set OBS end time (last epoch) to Y M D h m s
    -O.int[erval,sec] #      set OBS observation interval to # ( > 0.)
seconds
    -O.leap #                set OBS leap seconds to #
    -O.mn "str"              set OBS monument number to "str"
    -O.mo[nument] "str"      set OBS monument name to "str"
    -O.o[perator] "str"      set OBS operator name to "str"
    -O.rename_obs "str"      rename OBS observables to "str"
                                    "str" = L1L2C1P2 renames 4 observables
to be L1 L2 C1 P2, and in that order
    -O.obs[_types] "str"     change OBS observables to "str"
                                    "str" = L1L2C1P2 sets 4 observables to
be L1 L2 C1 P2, and in that order
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    -O.rn "str"              set OBS receiver number to "str"
    -O.rt "str"              set OBS receiver type to "str"
    -O.rv "str"              set OBS receiver version to "str"
    -O.r[un_by] "str"        set OBS run by to "str"
    -O.s[ystem] #            set OBS satellite system to # (= G, R, S, T, or
M)
    -O.sl[ant] s d dh        set OBS antenna position eccentricities to
dh+sqrt(s^2 - (d/2)^2) 0 0 (in meters)
    -O.st[art] Y M D h m s   set OBS start time (first epoch) to Y M D h m s
  -N.{opt} arg(s)      override any existing NAV header {opt} with arg(s):
    -N.a[lpha] a0 a1 a2 a3   set NAV ionosphere alpha parameters to a0 a1 a2
a3
    -N.b[eta] b0 b1 b2 b3    set NAV ionosphere beta parameters to b0 b1 b2
b3
    +N.c[omment] "str"       append NAV comment "str"
    -N.corr yr mon day sec      set NAV correction to system time to yr mon
day sec
    -N.dec[imate] #          modulo decimation of NAV ToE epochs to # time
units
                                    # = 12h results in ToE epochs at 00 and
12 hours
    -N.leap #                set NAV leap seconds to #
    -N.r[un_by] "str"        set NAV run by to "str"
    -N.s[ystem] #            set NAV satellite system to # (= G, R, T, or M)
    -N.UTC A0 A1 t w         set NAV UTC time model to A0 A1 t w
  -M.{opt} arg(s)      override any existing MET header {opt} with arg(s):
    +M.c[omment] "str"       append MET comment "str"
    -M.dec[imate] #          modulo decimation of MET epochs to # time units
                                    # = 15m results in epochs at 00, 15,
30, and 45 minutes
    -M.int[erval,sec] #      set MET observation interval to # ( > 0.)
seconds

    -M.mn "str"              set MET monument number to "str"
    -M.mo[nument] "str"      set MET monument name to "str"
    +M.mod[el/type/acc] "obs" "model" "type" accuracy  set "obs" MET sensor
mod/type/acc to "model" "type" accuracy
                                    "obs" = HR, PR, TD, or ZW
    -M.rename_obs "str"      rename MET observables to "str"
                                    "str" = TD+HR+PR renames 3 observables
to be TD HR PR, and in that order
    -M.obs[_types] "str"     change MET observables to "str"
                                    "str" = TD+HR+PR sets 3 observables to
be TD HR PR, and in that order
    +M.pos[ition] "obs" x y z h  set "obs" MET sensor XYZ/H to x y z h
                                    "obs" = HR, PR, TD, or ZW
    -M.r[un_by] "str"        set MET run by to "str"
  -qc                  turn off quality check (default)
  +qc                  quality checking (w/ following options):
    +ap                      turn average position on
    -ap                      turn off (default)
    +eep                     turn every epoch position (silent) on
    -eep                     turn off (default)
    +eepx                    turn every epoch position (xyz cartesian)on
    -eepx                    turn off (default)
    +eepg                    turn every epoch position (geographical) on
    -eepg                    turn off (default)
    +cl[ock_slips]           turn clock n-msec slip detection on (default)
    -cl[ock_slips]           turn off
    -code_sigmas #           set maximum tolerace for code rejection to #
(default = 2.0)
    +data[indicators]        turn data indicators on qc ASCII plot on
(default)
    -data[indicators]        turn off
    -eps[ilon] #             set machine epsilon to # (default =
1.387779e-17)
    +hor[izon]               when possible, show SV information down to
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horizon (default)
    -hor[izon]              turn off
    +ion                    compute L2-ionospheric observable (default)
    -ion                    turn off
    +iod                    compute L2-ionospheric derivative (default)
    -iod                    turn off
    +tec                    compute TEC observable
    -tec                    turn off (default)
    -ion_bins #             use # elevation bins between horizon and zenith
for ionospheric observable (default = 18)
    -ion_jump[cm] #         set maximum L2-ionospheric change to be # cm
(default = 1.000e+35)
    -iod_jump[cm/min] #     set maximum L2-ionospheric time-rate of change
to be # cm/minute (default = 400.0)
    -gap_mn[min] #          set minimum gap allowed # minutes (default =
10.0)
    -gap_mx[min] #          set maximum gap allowed w/o NAV info to #
minutes (default = 90.0)
    -glonass_n str          str = GLONASS SV and frequency number file
    +l[ong_report]          write a long report file segment (default)
    -l[ong_report]          don't write a long report file segment
    +lli                    turn Loss-of-Lock indicator on (default)
    -lli                    turn off
    +ma                     turn multipath moving average on (default)
    -ma                     turn off
    +mask                   when possible, show SV information down to
elevation mask
    -mask                   turn off (default)
    -min_L1 #               set minimum allowable L1 S/N RINEX code to 0 <=
# <= 9 (default = 0)
    -min_L2 #               set minimum allowable L2 S/N RINEX code to 0 <=
# <= 9 (default = 0)
    -min_SVs #              set minimum allowable SVs w/ 2 codes (per OBS
epoch) to # for position attempt (default = 5)
    +mp                     compute L1 and L2 multipath observables
(default)
    -mp                     turn off
    -mp1_rms[cm] #          set expected MP1 rms to # cm (default = 50.00)
    -mp2_rms[cm] #          set expected MP2 rms to # cm (default = 65.00)
    -mp_bins #              use # elevation bins between horizon and zenith
for mulitpath (default = 18)
    +mp_raw                 show raw multipath (no slip removal)
    -mp_raw                 show multipath (if being done) w/ slip removal
(default)
    -mp_sigmas #            set minimum sigma threshold for mp slips to #
sigmas (default = 4.0)
    -mp_win #               set multipath moving average window to # (<
65536) points (default = 50)
    -mp_CA_AS[%rms] #       set % increase of multipath rms to # if CA or
AS present (default = 100.0)
    -msec_tol[msec] #       set millisecond clock slip tolerance to # msec
(default = 1.00e-02)
    -nav[file(s)] name      input NAV file(s) "name" for ephemeris data (to
perform position calculations)
    -p[ortrait][#[u]]       qc ASCII plot plot in "portrait" mode; bin
length in # units u (default u == m[inutes])
    -path_dt[min] #         set sampling of SV cubic spline fit to #
minutes (default = 10)
    +pl                     compute L1 and L2 pseudorange-phase observables
    -pl                     turn off (default)
    +plot                   write plot file(s) (default)
    -plot                   don't write plot file(s)
    +pos[ition]             find antenna position and terminate teqc ASAP
    -pos[ition]             run teqc normally (default)
    -pos_conv[m] #          set position convergence to # ( > 0) meters
(default = 1.000000e+00 m)
    -pos_jump[m] #          set position jump detection to # ( > 0) meters
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(default = 1.000000e+05 m)
    +rep[ort]               write a report file (default)
    -rep[ort]               don't write any report file
    +reset                  find antenna position and reset OBS file
(default)
    -reset                  only one pass of each OBS file allowed (default
if using stdin)
    -root str               supply filename root for ancillary files as str
    +rs                     compute rise and set times of each SV w/ NAV
info (default)
    -rs                     don't compute rise and set times
    +s[hort_report]         write a short report file segment (default)
    -s[hort_report]         don't write a short report file segment
    -set_comp[arison,deg] #  set elevation comparison to # degrees (default
= 25.00)
    -set_hor[izon,deg] #    set elevation horizon to # degrees (default =
0.00)
    -set_mask[deg] #        set elevation mask to # degrees (default =
10.00)
    +sn[ratio]              compute S/N observables (default)
    -sn[ratio]              turn off
    -sn_bins #              use # elevation bins between horizon and zenith
for S/N (default = 18)
    +ssv                    give individual SUM lines for each SV
    -ssv                    turn off (default)
    +sym[bol_codes]         dump symbol codes and hierarchy for short
report ASCII time plot
    -sym[bol_codes]         don't dump symbol codes and hierarchy (default)
    -w[idth] #              set time width of qc ASCII plot to 0 < # < 256
(default = 72)
    +Y[-code]               Y-code receiver expected
    -Y[-code]               P-code receiver expected (possible tracking of
P-codes w/ A/S on) (default)
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