

2005 GPS Equipment Survey—Geodetic Receivers

MANUFACTURER/DISTRIBUTOR	ITT Industries	Leica Geosystems	Leica Geosystems	Leica Geosystems	Leica Geosystems	Leica Geosystems	Leica Geosystems
RECEIVER MODEL	Rascal-8	GX1230	GX1220	GX1210	GRX1200 Lite	GRX1200 Classic	GRX1200 Pro
Manufacturer's phone number	805/495-8420	800/367-9453	800/367-9453	800/367-9453	800/367-9453	800/367-9453	800/367-9453
Receiver tracking characteristics							
Single-frequency or dual-frequency GPS?	Dual	Dual	Dual	Single	Dual	Dual	Dual
L1 C/A code, L1 carrier				Yes			
L1 only, codeless							
L1 only, C/A-code							
L1 codeless and L2 codeless							
L1 C/A-code and L2 codeless							
L1 C/A-code and P-code, L2 P-code		Yes	Yes		Yes	Yes	Yes
L1 C/A-code and L2 P-code							
Other	[2]						
GLONASS?	No	No	No	No	No	No	No
WAAS?	No	Yes	Yes	Yes	Yes	Yes	Yes
Max. number of satellites tracked simultaneously	8	12	12	12	12	12	12
Number of receiver channels	24	24	24	12	24	24	24
Selectable data interval for phase measurement?	1 to 3600 seconds	0.05 to 300	0.05 to 300	0.05 to 300	0.05 to 300	0.05 to 300	0.05 to 300
When four satellites are tracked, does the receiver display provide:							
Satellite tracking status?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Coordinated Universal Time (UTC)?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Three-dimensional positions?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Velocity?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Dilution of precision?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Real-time map display with linework and background	No	Yes	Yes	Yes	Yes	Yes	Yes
Touch screen display?	No	Yes	Yes	Yes	Yes	Yes	Yes
Coordinates in grid, local or ground values? If yes, state which.	Yes [1]	Geoid/Grid/Ellipsoid	Geoid/Grid/Ellipsoid	Geoid/Grid/Ellipsoid	Geoid/Grid/Ellipsoid	Geoid/Grid/Ellipsoid	Geoid/Grid/Ellipsoid
Horizontal Accuracy (Std. Dev.)							
Static (cm)	0.4 cm + 0.5 ppm	0.5 cm + 0.5 ppm	0.5 cm + 0.5 ppm	1 cm + 1 ppm	0.3 mm + 0.5 ppm	0.3 mm + 0.5 ppm	0.3 mm + 0.5 ppm
RTK (cm)	1 cm + 1 ppm	1 cm + 1 ppm	1 cm + 1 ppm				
Does the receiver accurately measure and output:							
Code Phase?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Carrier Phase?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Integrated Doppler?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo-range data?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Full wavelength L2 carrier-phase data when A/S is implemented?	No	Yes	Yes	No	Yes	Yes	Yes
Cross-correlated Y2 - Y1 pseudoranges?	Yes						
Other dual-frequency technology							
Specify available observables (e.g. L1 C/A, L1 Phase, etc.)	[2]	[8]	[8]	L1 Phase, L1 C/A	[8]	[8]	[8]
On what medium is observed data recorded during the observations?							
Internal memory?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Other medium?		Compact Flash	Compact Flash	Compact Flash	Compact Flash	Compact Flash	Compact Flash
If recorded in the internal memory, what medium is available to transfer to after the observations end? (serial port, IR port, USB port, removable media memory, other)		[9]	[9]	[9]	[9]	[9]	[9]
Maximum internal memory capacity (Mb)	Upgradable to 16 Mb	256 Mb (optional)	256 Mb (optional)	256 Mb (optional)	256 Mb (optional)	256 Mb (optional)	256 Mb (optional)
Maximum data transfer speed from internal memory to PC (baud)	38,400	115,200	115,200	115,200	115,200	115,200	115,200
RECEIVER INTERFACE							
Are the following supported on the single component of the system, which includes the Receiver (Rx), or the controller or handheld computer (C) or both (B).							
Alpha-numeric entry of data							
Text warnings	[3]	C	C	C	C	C	C
Setting of receiver parameters	[3]	C	C	C	C	C	C
Receiver status	[3]	C	C	C	C	C	C
Messages formed with LEDs	[3]	B	B	B	B	B	B
Messages formed with LCDs	[3]	Rx	Rx	Rx	Rx	Rx	Rx
Can receiver be used in a vehicle for positioning and navigation?	[3]	C	C	C	C	C	C
Can the receiver perform:	[3]	Yes	Yes	Yes	Yes	Yes	Yes
Kinematic surveys?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo-kinematic surveys?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Rapid static surveys?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Can the receiver perform real-time kinematic surveys?	Yes	Yes	No	No			
If yes, does it have on-the-fly ambiguity resolution capabilities?		Yes		N/A			
Is RTK radio internal or external?	External	External		N/A			
Use of multiple RTK base stations on a single radio	No	Yes		N/A			
Can the receiver perform real-time Differential GPS (DGPS)?	No	Yes	Yes	Yes (optional)	Yes	Yes	Yes
Is the receiver capable of picking up signals from U.S. Coast Guard beacons?	No	Yes	Yes	Yes (optional)			
Is the receiver capable of picking up signals from the commercially available DGPS service companies?	No	Yes	Yes	Yes (optional)			
Time to first satellite signal lock (seconds)	30	30	30	30	30	30	30
For all available satellites? (seconds)	<90	50	50	50	50	50	50
Can the system be preprogrammed or initialized with session observing criteria at an office before going to the sites?	No	Yes	Yes	Yes			
If yes, can the system be programmed with information for multiple sessions?		Yes	Yes	Yes			
If the system can be preprogrammed, can alphanumeric data be input?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Does the receiver give some indication that data is being recorded?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Size: (H x W x D)	8.6 x 4.1 x 1.9	3.1 x 6.5 x 8	3.1x6.5x8	3.1x6.5x8			
Weight: (lbs. Receiver only)	2.2	2.6	2.6	2.6	2.6	2.6	2.6
Is antenna included in the weight?	No	No	No	No	No	No	No
Weight (lbs. Complete RTK rover-receiver, antenna, controller, radio, pole, batteries)	8.5	7.9	N/A				N/A
Receiver housing material (e.g. plastic, metal)	Magnesium alloy	Magnesium	Magnesium	Magnesium	Magnesium	Magnesium	Magnesium
Humidity proofing (e.g. 95%, 100% non-condensing)	100%	100%	100%	100%	100%	100%	100%
Drop height survival (m/ft)	5 ft	1.5 m	1.5 m	1.5 m	1 m	1 m	1 m
Waterproofing (e.g. IPX5, IPX6, IPX7)	[4]	IP67	IP67	IP67	MIL-STD-810F	MIL-STD-810F	MIL-STD-810F
Operating Temperature Range (degrees F/C)	-20 to 55°C	-40 to 65°C	-40 to 65°C	-40 to 65°C	-45 to 65°C	-40 TO 65°C	-40 to 65°C
Is standard battery internal?	No	Yes	Yes	Yes	No	No	No
Hours of operation at 0 degrees C with standard battery	8	5 (single battery)	5 (single battery)	5 (single battery)			
Input voltage range (v)	6VDC	10.5 to 28	10.5 to 28	10.5 to 28	10.5 to 28	10.5 to 28	10.5 to 28
Power consumption? (watts, receiver only)	<5 W	3.8	3.8	3.8	3.8	3.8	3.8
Power consumption? (watts complete RTK rover inc. receiver, antenna, radio, controller)	<5.5 W					N/A	N/A
Has the system (including all components) been tested by the (FGCS)*?	[5]						
ANTENNA							
Type:	Helical	AX1202	AX1202	AX1201	AX1202	AX1202	AX1202
Is antenna built into the receiver?	No	No	No	No	No	No	No
If yes, is antenna removable?							
If it is not removable, is there a provision for an external antenna?							
Weight, antenna (lbs.)	1.5	0.97	0.97	0.97	0.97	0.97	0.97
Length of antenna cable furnished with receiver?	8 ft.	2.8 m typical	2.8 m typical	2.8 m typical	2.8 m typical	2.8 m typical	2.8 m typical
Maximum length of antenna cable that can be used?	[6]	60+ m w/ amplifiers	60+ m w/ amplifiers	60+ m w/ amplifiers	60+ m w/ amplifiers	60+ m w/ amplifiers	60+ m w/ amplifiers
Is a system available for postprocessing data?	Yes, TurboSurvey S/W 2	Yes	Yes	Yes	Yes	Yes	Yes
U.S. SUGGESTED LIST PRICE (\$)	Consult ITT Industries	Contact Leica Geosystems	Contact Leica Geosystems	Contact Leica Geosystems	Contact Leica Geosystems	Contact Leica Geosystems	Contact Leica Geosystems
Receiver?	Consult ITT Industries	Contact Leica Geosystems	Contact Leica Geosystems	Contact Leica Geosystems	Contact Leica Geosystems	Contact Leica Geosystems	Contact Leica Geosystems
Antenna?	Consult ITT Industries	Contact Leica Geosystems	Contact Leica Geosystems	Contact Leica Geosystems	Contact Leica Geosystems	Contact Leica Geosystems	Contact Leica Geosystems
Postprocessing hardware and software?	Consult ITT Industries	Contact Leica Geosystems	Contact Leica Geosystems	Contact Leica Geosystems	Contact Leica Geosystems	Contact Leica Geosystems	Contact Leica Geosystems
WARRANTY (months)	12						
Receiver?	12	12	12	12	12	12	12
Antenna?	12	12	12	12	12	12	12
Postprocessing hardware?	Consult ITT Industries	12 (with support contract)	12 (with support contract)	12 (with support contract)	12 (with support contract)	12 (with support contract)	12 (with support contract)
ADVANCED FEATURES	[7]	[10]	[10]	[10]	[10]	[10]	[10]

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MANUFACTURER/DISTRIBUTOR	Leica Geosystems	NavCom Technology Inc.	NavCom Technology Inc.	NavCom Technology Inc.	NavCom Technology Inc.	NavCom Technology Inc.	NavCom Technology Inc.
RECEIVER MODEL	SR20	SF-2040G	SF-2050G/M/R	RT-3010S	RT-3020S/M	NCT-2030M	VueStar
Manufacturer's phone number	800/367-9453	310/381-2000	310/381-2000	310/381-2000	310/381-2000	310/381-2000	310/381-2000
Receiver tracking characteristics							
Single-frequency or dual-frequency GPS?	Single	Dual	Dual	Dual	Dual	Dual	Dual
L1 C/A code, L1 carrier	Yes						
L1 only, codeless							
L1 only, C/A-code							
L1 codeless and L2 codeless							
L1 C/A-code and L2 codeless							
L1 C/A-code and P-code, L2 P-code		Yes	Yes	Yes	Yes	Yes	Yes
L1 C/A-code and L2 P-code							
Other							
GLONASS?	No	No	No	No	No	No	No
WAAS?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Max. number of satellites tracked simultaneously	12	12 GPS + 2 SBAS	12 GPS + 2 SBAS	12 GPS + 2 SBAS	12 GPS + 2 SBAS	12 GPS + 2 SBAS	12 GPS + 2 SBAS
Number of receiver channels	12	24 GPS + 2 SBAS	24 GPS + 2 SBAS	24 GPS + 2 SBAS	24 GPS + 2 SBAS	24 GPS + 2 SBAS	24 GPS + 2 SBAS
Selectable data interval for phase measurement?	0.05 to 300	0.02 to 800 secs	0.02 to 800 secs	0.02 to 800 secs	0.02 to 800 secs	0.02 to 800 secs	0.02 to 800 secs
When four satellites are tracked, does the receiver display provide:							
Satellite tracking status?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Coordinated Universal Time (UTC)?	Yes	Yes [11]	Yes [11]	Yes [11]	Yes [11]	Yes [18]	Yes [11]
Three-dimensional positions?	Yes	Yes [11]	Yes [11]	Yes [11]	Yes [11]	Yes [18]	Yes [11]
Velocity?	Yes	Yes [11]	Yes [11]	Yes [11]	Yes [11]	Yes [18]	Yes [11]
Dilution of precision?	Yes	Yes [11]	Yes [11]	Yes [11]	Yes [11]	Yes [18]	Yes [11]
Real-time map display with linework and background	Yes	Yes [11]	Yes [11]	Yes [11]	Yes [11]	Yes [11]	Yes [11]
Touch screen display?	Yes	Yes [11]	Yes [11]	Yes [11]	Yes [11]	Yes [11]	Yes [11]
Coordinates in grid, local or ground values? If yes, state which.	Geoid/Grid/Ellipsoid	Yes [11]	Yes [11]	Yes [11]	Yes [11]	Yes [11]	Yes [11]
Horizontal Accuracy (Std. Dev.)							
Static (cm)	0.5 cm + 2 ppm	0.5 + 1 ppm	0.5 + 1 ppm	0.5 + 1 ppm	0.5 + 1 ppm	0.5 + 1 ppm	0.5 + 1 ppm
RTK (cm)		1.0 + 1 ppm	1.0 + 1 ppm	1.0 + 1 ppm	1.0 + 1 ppm	1.0 + 1 ppm	1.0 + 1 ppm
Does the receiver accurately measure and output:							
Code Phase?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Carrier Phase?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Integrated Doppler?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo-range data?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Full wavelength L2 carrier-phase data when A/S is implemented?	No	Yes	Yes	Yes	Yes	Yes	Yes
Cross-correlated Y2 - Y1 pseudoranges?	No	No	No	No	No	No	No
Other dual-frequency technology	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Specify available observables (e.g. L1 C/A, L1 Phase, etc.)	L1 Code/L1 Phase	[12]	[12][13]	[12]	[12]	[12]	[12][13]
On what medium is observed data recorded during the observations?							
Internal memory?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Other medium?	Compact Flash	Serial to PC/PDA	Serial to PC/PDA	Serial to PC/PDA	Serial to PC/PDA	Serial to PC/PDA	Serial to PC/PDA
If recorded in the internal memory, what medium is available to transfer to after the observations end? (serial port, IR port, USB port, removable media memory, other)	[9]	Serial	Serial	Serial	Serial	Serial	Serial
Maximum internal memory capacity (Mb)	256 Mb (optional)	64	64	64	64	64	64
Maximum data transfer speed from internal memory to PC (baud)	115200	115K	115K	115K	115K	115K	115K
RECEIVER INTERFACE							
Are the following supported on the single component of the system, which includes the Receiver (Rx), or the controller or handheld computer (C) or both (B).							
Alpha-numeric entry of data	C	C	C	C	C	C	C
Text warnings	C	C	C	C	C	C	C
Setting of receiver parameters	C	C	C	C	C	C	C
Receiver status	C	C	C	C	C	C	C
Messages formed with LEDs	C	B	B	B	B	B	B
Messages formed with LCDs	C	C	C	C	C	C	C
Can receiver be used in a vehicle for positioning and navigation?	C	C	C	C	C	C	C
Can the receiver perform:		Yes	Yes	Yes	Yes	Yes	Yes
Kinematic surveys?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo-kinematic surveys?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Rapid static surveys?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Can the receiver perform real-time kinematic surveys?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
If yes, does it have on-the-fly ambiguity resolution capabilities?		Yes	Yes	Yes	Yes	Yes	Yes
Is RTK radio internal or external?		External	External	Internal	Internal	External	External
Use of multiple RTK base stations on a single radio		N/A	N/A	Yes	Yes	N/A	N/A
Can the receiver perform real-time Differential GPS (DGPS)?	Yes (optional)	Yes	Yes	Yes	Yes	Yes	Yes
Is the receiver capable of picking up signals from U.S. Coast Guard beacons?	Yes (optional)	No	No				
Is the receiver capable of picking up signals from the commercially available DGPS service companies?	Yes (optional)	Yes, StarFire	Yes, StarFire	No	No	No	No
Time to first satellite signal lock (seconds)	30	30	30				Yes, StarFire
For all available satellites? (seconds)	50	<60	<60	30	30	30	30
Can the system be preprogrammed or initialized with session observing criteria at an office before going to the sites?		No	No	<60	<60	<60	<60
If yes, can the system be programmed with information for multiple sessions?				No	No	No	No
If the system can be preprogrammed, can alphanumeric data be input?							
Does the receiver give some indication that data is being recorded?	Yes						
Size: (H x W x D)	8.5 x 3.5 x 1.9	5.5H x 10.4 D	3.1 x 5.7 x 8.2	5.5H x 10.4 D	3.1 x 5.7 x 8.2	3.1 x 5.7 x 8.2	3.1 x 5.7 x 8.2
Weight: (lbs. Receiver only)	1.4	5.5	4	5.5	4	3.6	4
Is antenna included in the weight?	No	Yes	Yes	Yes	Yes	Yes	Yes
Weight (lbs. Complete RTK rover-receiver, antenna, controller, radio, pole, batteries)		[14]	[14]	[14]	[14]	[14]	[14]
Receiver housing material (e.g. plastic, metal)	Polycarbonate	Alloy/UV stable plastic	Alloy	Alloy/UV stable plastic	Alloy	Alloy	Alloy
Humidity proofing (e.g. 95%, 100% non-condensing)	99%	95%	95%	95%	95%	95%	95%
Drop height survival (m/ft)	1.2 m	2 m/6 ft		2 m/6 ft			
Waterproofing (e.g. IPX5, IPX6, IPX7)	IP54						
Operating Temperature Range (degrees F/C)	-20 to 55°C	-40 to 55°C	-40 to 55°C	-40 to 55°C	-40 to 55°C	-40 to 55°C	-40 to 55°C
Is standard battery internal?	Yes	Yes	No	Yes	No	No	No
Hours of operation at 0 degrees C with standard battery		10		15			
Input voltage range (v)	7.2	10 to 30	10 to 30	10 to 30	10 to 30	10 to 30	10 to 30
Power consumption? (watts, receiver only)	2.1	<8	<8	<5	<5	<4	<8
Power consumption? (watts complete RTK rover inc. receiver, antenna, radio, controller)		[14]	[14]	[14]	[14]	[14]	[14]
Has the system (including all components) been tested by the (FGCS)*?		No	No	No	No	No	No
ANTENNA							
Type:	AT 575	Drooped dipole	Drooped dipole	Drooped dipole	Drooped dipole	Drooped dipole	FAA certified dipole
Is antenna built into the receiver?	No	Yes	No	Yes	No	No	No
If Yes, is antenna removable?		No	No	No	No	No	No
If it is not removable, is there a provision for an external antenna?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Weight, antenna (lbs.)		1	1	1	1	1	1
Length of antenna cable furnished with receiver?	2.8 m typical	N/A	10 ft	N/A	10 ft	10 ft	10 ft
Maximum length of antenna cable that can be used?	60+ m	N/A	[17]	N/A	[17]	[17]	[17]
Is a system available for postprocessing data?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
U.S. SUGGESTED LIST PRICE (\$) Receiver?	Contact Leica Geosystems						
Antenna?	Contact Leica Geosystems						
Postprocessing hardware and software?	Contact Leica Geosystems						
WARRANTY (months)							
Receiver?	12	12	12	12	12	12	12
Antenna?	12	12	12	12	12	12	12
Postprocessing hardware?	12 (with support contract)	N/A	N/A	N/A	N/A	N/A	N/A
ADVANCED FEATURES	[10]	[15]	[15][16]	50 Hz data option	[15][16]	RTK, 50 Hz data options	RTK, 50 Hz data options

*Federal Geodetic Control Subcommittee Numbers in brackets refer to notes on pages 59 and 60.

2005 GPS Equipment Survey—Geodetic Receivers

MANUFACTURER/DISTRIBUTOR	SOKKIA	SOKKIA	SOKKIA	SOKKIA	Thales Navigation	Thales Navigation
RECEIVER MODEL	GSR2650 LB	GSR2600	Stratus	GSR2700 R5	MicroZ CGRS	iCGR5
Manufacturer's phone number	800/255-3913	800/255-3913	800/255-3913	800/255-3913	800/922-2401	800/922-2401
Receiver tracking characteristics						
Single-frequency or dual-frequency GPS?	Dual	Dual	Single	Dual	Dual	Dual
L1 C/A code, L1 carrier			Yes			
L1 only, codeless						
L1 only, C/A-code						
L1 codeless and L2 codeless						
L1 C/A-code and L2 codeless						
L1 C/A-code and L2 P-code				Yes P(Y)	Yes	Yes
L1 C/A-code and L2 P-code						
Other	[20][21]	[20]				
GLONASS?	No	No	No	No	No	No
WAAS?	Yes	Optional	No	Optional	No	No
Max. number of satellites tracked simultaneously	[22]	12	12	12	12	12
Number of receiver channels	25	24	12	24	24	24
Selectable data interval for phase measurement?	0.05 to 60 secs	0.05 to 60 secs		0.05 to 60 secs	0.1 to 999 sec	0.1 to 999 sec
When four satellites are tracked, does the receiver display provide:						
Satellite tracking status?	Yes	Yes	Yes	[27]	Yes	Yes
Coordinated Universal Time (UTC)?	[23]	Yes	[23]	[27]	No	No
Three-dimensional positions?	[23]	Yes	[23]	[27]	No	No
Velocity?	[23]	Yes	No	[27]	No	No
Dilution of precision?	[23]	Yes	[23]	[27]	No	No
Real-time map display with linework and background	[23]	[23]	No	No	No	No
Touch screen display?	[23]	[23]	[23]	No	No	No
Coordinates in grid, local or ground values? If yes, state which.	[23]	[23]	[23]	[27]	No	No
Horizontal Accuracy (Std. Dev.)						
Static (cm)	0.5 cm + 1 ppm	0.3 cm + 1 ppm	0.5 + 1 ppm	0.3 + 0.5 ppm	0.3	0.3
RTK (cm)	1.0 cm + 1 ppm	1.0 cm + 1 ppm	N/A	1.0 + 1 pm	N/A	N/A
Does the receiver accurately measure and output:						
Code Phase?	Yes	Yes	Yes	Yes	Yes	Yes
Carrier Phase?	Yes	Yes	Yes	Yes	Yes	Yes
Integrated Doppler?	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo-range data?	Yes	Yes	Yes	Yes	Yes	Yes
Full wavelength L2 carrier-phase data when A/S is implemented?	Yes	Yes	No	Yes	Yes	Yes
Cross-correlated Y2 - Y1 pseudoranges?	No	No	No	No	No	No
Other dual-frequency technology	Yes	Yes	No	Yes	Yes	Yes
Specify available observables (e.g. L1 C/A, L1 Phase, etc.)	L1/L2 code and carrier	L1/L2 code and carrier	L1 full code and carrier	L1/L2 code and carrier	[33]	[33]
On what medium is observed data recorded during the observations?					Flash	Flash
Internal memory?	No	CompactFlash card	Yes	Computer hard drive	Yes	Yes
Other medium?	Serial to PC/PDA	Serial to PC/PDA	IR transfer to PDA		Serial port to PC	Serial port to PC
If recorded in the internal memory, what medium is available to transfer to after the observations end? (serial port, IR port, USB port, removable media memory, other)	N/A	Eject card or serial transfer	Serial and IR	Download [27]	Serial port to PC	Serial port to PC
Maximum internal memory capacity (Mb)	N/A	Varies with CF card	4	[28]	128	128
Maximum data transfer speed from internal memory to PC (baud)	N/A	115K baud	115200	N/A	115200	115200
RECEIVER INTERFACE						
Are the following supported on the single component of the system, which includes the Receiver (Rx), or the controller or handheld computer (C) or both (B).						
Alpha-numeric entry of data						
Text warnings	C	B	C	No	C	C
Setting of receiver parameters	C	B	C	[27]	C	C
Receiver status	C	B	C	[27]	C	C
Messages formed with LEDs	B	B	B	B	C	C
Messages formed with LCDs	Rx	Rx	Rx	B	No	No
Can receiver be used in a vehicle for positioning and navigation?	C	B	C	N/A	No	No
Can the receiver perform:	Yes	Yes	Yes	No	Yes	Yes
Kinematic surveys?	Yes	Yes	Yes	Yes, as base only	Yes	Yes
Pseudo-kinematic surveys?	Yes	Yes	Yes	Yes, as base only	Yes	Yes
Rapid static surveys?	Yes	Yes	Yes	Yes, as base only	Yes	Yes
Can the receiver perform real-time kinematic surveys?	Yes	Yes	No	Yes, as base only	No	No
If yes, does it have on-the-fly ambiguity resolution capabilities?	Yes	Yes	N/A	N/A		
Is RTK radio internal or external?	[24]	External	N/A	[29]		
Use of multiple RTK base stations on a single radio	Yes	Yes	N/A	[30]		
Can the receiver perform real-time Differential GPS (DGPS)?	Yes	Yes	No		No	No
Is the receiver capable of picking up signals from U.S. Coast Guard beacons?	No	No	No	No	No	No
Is the receiver capable of picking up signals from the commercially available DGPS service companies?	Yes, OmniStar, CDGPS	No	No	No	No	No
Time to first satellite signal lock (seconds)	<10	<10	<40 warm	<10	5	5
For all available satellites? (seconds)	<60	<60	<60	<60	30	30
Can the system be preprogrammed or initialized with session observing criteria at an office before going to the sites?	No	Yes	Yes	Yes	Yes	Yes
If yes, can the system be programmed with information for multiple sessions?	N/A	Yes	No	Yes	Yes	Yes
If the system can be preprogrammed, can alphanumeric data be input?	N/A	Yes	Yes	Yes	Yes	Yes
Does the receiver give some indication that data is being recorded?	N/A	Yes	Yes via LED	[27]	Yes	Yes
Size: (H x W x D)	2.8 x 6.1 x 7.1	2.8 x 6 x 7.0	5.0 x 6.0	1.8 x 16.9 x 23.9	2.5 x 7 x 9.6	2.5 x 7 x 9.6
Weight: (lbs. Receiver only)	2.4	2.9	1.38	24.5	3.75	3.75
Is antenna included in the weight?	No	No	Yes	No	No	No
Weight (lbs. Complete RTK rover-receiver, antenna, controller, radio, pole, batteries)	Approx. 9	Approx. 9	1.75	N/A	N/A	N/A
Receiver housing material (e.g. plastic, metal)	Aluminum	Aluminum	Plastic	Metal	Metal	Metal
Humidity proofing (e.g. 95%, 100% non-condensing)	95%	95%	95%	95%	100%	100%
Drop height survival (m/ft)	1 m	1 m	[26]	N/A	Mil Std 810E	N/A
Waterproofing (e.g. IPX5, IPX6, IPX7)	IPX4, IPX7	IPX7	IPX4	N/A		Mil Std 810E
Operating Temperature Range (degrees F/C)	-40 to 167°F (-40 to 75°C)	-40 to 131°F (-40 to 55°C)	-20 to 65°C (-4 to 149°F)	5 to 35°C (41 to 95°F)	-40 to 60°C	-40 to 55°C
Is standard battery internal?	No	No	Yes	AC powered	No	No
Hours of operation at 0 degrees C with standard battery	8-12	9 hours	30 hr @ -20 C	AC powered	N/A	N/A
Input voltage range (v)	7 to 15	7 - 18	7.2 VDC	110-220 V AC power	10 to 28	10 to 28
Power consumption? (watts, receiver only)	5	<3	<1	[31]	5.6	6.6
Power consumption? (watts complete RTK rover inc. receiver, antenna, radio, controller)	Varies with configuration	Varies with configuration	<1	[31]	N/A	N/A
Has the system (including all components) been tested by the (FGCS)*?	No	No	No	No	No	No
ANTENNA						
Type:	SK 600 LB PinWheel	SK-702 PinWheel	Internal patch	Various	Choke ring	Choke ring
Is antenna built into the receiver?	No	No	Yes	No	No	No
If yes, is antenna removable?	No	No	No	N/A	N/A	N/A
If it is not removable, is there a provision for an external antenna?	No	No	No	N/A	N/A	Yes
Weight, antenna (lbs.)	1.61	1.06	1.38	Varies	9.4	9.4
Length of antenna cable furnished with receiver?	2.5 m	2.5 m	N/A	Varies	30 m	30 m
Maximum length of antenna cable that can be used?	Custom	Custom	N/A	Varies	60 m	60 m
Is a system available for postprocessing data?	Yes	Yes	Yes	Yes	Yes	Yes
U.S. SUGGESTED LIST PRICE (\$)						
Receiver?	Contact SOKKIA	Contact SOKKIA	Contact SOKKIA	Contact SOKKIA	On request	On request
Antenna?	Contact SOKKIA	Contact SOKKIA	Contact SOKKIA	Contact SOKKIA	On request	On request
Postprocessing hardware and software?	Contact SOKKIA	Contact SOKKIA	Contact SOKKIA	Contact SOKKIA	On request	On request
WARRANTY (months)					12	12
Receiver?	12	12	12	12	12	12
Antenna?	12	12	12	12	12	12
Postprocessing hardware?		Updates free	Updates free	Updates free	12	12
ADVANCED FEATURES	[25]			[32]	[34]	[35]

2005 GPS Equipment Survey—Geodetic Receivers

MANUFACTURER/DISTRIBUTOR	Thales Navigation	Thales Navigation	Thales Navigation	Thales Navigation	Topcon	Topcon	Topcon
RECEIVER MODEL	Z-Max	ProMark2	Aquarius 01/02	Sagitta 01/02	Hiper XT	Legacy +	Legacy-E
Manufacturer's phone number	800/922-2401	800/922-2401	800/922-2401	800/922-2401	800/443-4567	800/443-4567	800/443-4567
Receiver tracking characteristics							
Single-frequency or dual-frequency GPS?	Dual	Single	Single/dual	Single/dual	Dual	Dual	Dual
L1 C/A code, L1 carrier	Yes	Yes	Aquarius01	Yes (Sagitta01)			
L1 only, codeless							
L1 only, C/A-code							
L1 codeless and L2 codeless							
L1 C/A-code and L2 codeless							
L1 C/A-code and P-code, L2 P-code	Yes		Aquarius02	Yes (Sagitta02)			
L1 C/A-code and L2 P-code	Yes						
Other							
GLONASS?	No		No	No	Yes	Yes	Yes
WAAS?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Max. number of satellites tracked simultaneously	12	12	12+2	12+2	20	20	20
Number of receiver channels	24	12	16/28	[41]	40	40	40
Selectable data interval for phase measurement?	0.1 to 999 sec	1-999			1 to 20 H	1 to 20 H	Yes, 1 to 20 H
When four satellites are tracked, does the receiver display provide:							
Satellite tracking status?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Coordinated Universal Time (UTC)?	Yes	Yes	Yes	Yes	Yes [42]	Yes [42]	Yes [43]
Three-dimensional positions?	Yes	Yes	Yes	Yes	Yes [42]	Yes [42]	Yes [43]
Velocity?	Yes	Yes	Yes	Yes	Yes [42]	Yes [42]	Yes [43]
Dilution of precision?	Yes	Yes	Yes	Yes	Yes [42]	Yes [42]	Yes [43]
Real-time map display with linework and background	Yes	Yes	No	No	Yes [42]	Yes [42]	No
Touch screen display?	Yes	No	N/A	N/A	No	No	No
Coordinates in grid, local or ground values? If yes, state which.	Yes	Yes	Yes	Yes	Both [42]	Both [42]	Yes, all [43]
Horizontal Accuracy (Std. Dev.)							
Static (cm)	0.5	0.5			[44]	[44]	[44]
RTK (cm)	1	N/A	0.5 + 0.5 ppm	0.5 + 0.5 ppm	[46]	[46]	[46]
Does the receiver accurately measure and output:							
Code Phase?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Carrier Phase?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Integrated Doppler?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo-range data?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Full wavelength L2 carrier-phase data when A/S is implemented?	Yes	No	Yes	Yes (Sagitta02)	Yes	Yes	Yes
Cross-correlated Y2 - Y1 pseudoranges?	N/A	No	No		Yes	Yes	Yes
Other dual-frequency technology	Patented Z-tracking	No			Yes	GLONASS	GLONASS
Specify available observables (e.g. L1 C/A, L1 Phase, etc.)	[36]	L1 code and carrier	[33]	[33]	[48]	[48]	
On what medium is observed data recorded during the observations?	Secure Digital Memory				Yes	Yes	Yes
Internal memory?	Yes	Yes	No	No	Yes (external PC)	Yes (external pc)	Yes
Other medium?	Serial port to PC	No	Serial to PC	Serial port to PC			
If recorded in the internal memory, what medium is available to transfer to after the observations end? (serial port, IR port, USB port, removable media memory, other)	[37]	Serial port		N/A	Bluetooth, serial, USB	Serial, USB	Serial
Maximum internal memory capacity (Mb)	128 Mb	8 Mb		N/A	1000	1000	1000
Maximum data transfer speed from internal memory to PC (baud)	3 Mb/sec	115200 baud		N/A	up to 460,800	460,800	460800
RECEIVER INTERFACE							
Are the following supported on the single component of the system, which includes the Receiver (Rx), or the controller or handheld computer (C) or both (B).							
Alpha-numeric entry of data							
Text warnings	B	Rx	Rx	Rx	C	C	C
Setting of receiver parameters	B	Rx	Rx	Rx	C	C	C
Receiver status	B	Rx	Rx	Rx	C	B	B
Messages formed with LEDs	B	Rx	Rx	Rx	B	B	B
Messages formed with LCDs	Rx	N/A	N/A	N/A	Rx	Rx	Rx
Can receiver be used in a vehicle for positioning and navigation?	C	Rx	Rx	Rx	C	C	C
Can the receiver perform:	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Kinematic surveys?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo-kinematic surveys?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Rapid static surveys?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Can the receiver perform real-time kinematic surveys?	Yes	No	Yes	Yes	Yes	Yes	Yes
If yes, does it have on-the-fly ambiguity resolution capabilities?	Yes	N/A	Yes	Yes	Yes	Yes	Yes
Is RTK radio internal or external?	Modular	N/A	Internal	Internal	Internal	External	External
Use of multiple RTK base stations on a single radio	Yes	N/A	Yes	Yes	Yes	Yes	Yes
Can the receiver perform real-time Differential GPS (DGPS)?	Yes	Yes	Yes	Yes	Yes	Yes (with external beacon receiver)	Yes
Is the receiver capable of picking up signals from U.S. Coast Guard beacons?	No	No	Yes	Yes	Yes [49]	Yes [49]	Yes [49]
Is the receiver capable of picking up signals from the commercially available DGPS service companies?	No	No	Yes	Yes	Yes [50]	Yes [50]	Yes [50]
Time to first satellite signal lock (seconds)	5	10	< 30	< 30	< 1	< 1	< 1
For all available satellites? (seconds)	20	30	< 60	< 60	< 10	< 10	10
Can the system be preprogrammed or initialized with session observing criteria at an office before going to the sites?	Yes	Yes	No	No	Yes	Yes	Yes
If yes, can the system be programmed with information for multiple sessions?	Yes	No			Yes	Yes	Yes
If the system can be preprogrammed, can alphanumeric data be input?	Yes	Yes	No	No	Yes	Yes	Yes
Does the receiver give some indication that data is being recorded?	Yes	Yes	No	No	Yes	Yes	Yes
Size: (H x W x D)		6.2 x 2 x 1.3	4.9 x 9.6 x 12	2.7 x 10.4 x 8.5	6.75 x 10.1 x 3.5	4.33 x 9.45 x 1.38	4.33 x 9.45 x 1.38
Weight: (lbs. Receiver only)	2.5	0.32	9.3	4.4	3.6	1.32	1.32
Is antenna included in the weight?	No	No	No	No	Yes	No	No
Weight (lbs. Complete RTK rover-receiver, antenna, controller, radio, pole, batteries)	7	2.5	9.3		Approx. 5	Approx. 5	Approx. 5
Receiver housing material (e.g. plastic, metal)	Magnesium alloy	Plastic	Metal	Metal	Aluminum/plastic	Aluminum	Aluminum
Humidity proofing (e.g. 95%, 100% non-condensing)		100%			Waterproof	Waterproof	Waterproof
Drop height survival (m/ft)	1.5 m	1.5 m			2 m	2 m	2 m
Waterproofing (e.g. IPX5, IPX6, IPX7)	IPX5	IPX7	IP52	IP52			
Operating Temperature Range (degrees F/C)	-30 to 55°C	-10 to 60°C	-20 to 55°C	-20 to 55°C	-20 to 55°C	-40 to 55°C	-40 to 55°C
Is standard battery internal?	Modular	Yes	No	No	Yes	No	No
Hours of operation at 0 degrees C with standard battery	14 hours	8 hours			> 12	8	8
Input voltage range (v)	10-24	N/A	9-36VDC	9-36VDC	6 to 28	6 to 28	6 to 28
Power consumption? (watts, receiver only)	5.0	0.35	less than 10W	less than 7W	< 3.3	< 3.3	< 3.3
Power consumption? (watts complete RTK rover inc. receiver, antenna, radio, controller)	5.5	N/A	less than 21W	less than 16W	< 4	4	4
Has the system (including all components) been tested by the (FGCS)*?	Test scheduled	Yes	No	No	No	No	Yes
ANTENNA							
Type:	Precision patch	Patch	NAP001 / NAP002	NAP001 / NAP002	Microstrip	PG-A1	PG-A1
Is antenna built into the receiver?	Modular	Yes	No	No	Yes	No	No
If yes, is antenna removable?	Yes	No			No		
If it is not removable, is there a provision for an external antenna?	Yes	Yes			Yes		
Weight, antenna (lbs.)	1.17	0.45				1	1
Length of antenna cable furnished with receiver?	3 m	4 ft	30 m	30 m		3 m	3 m
Maximum length of antenna cable that can be used?	30 m	4 ft			30 m [53]	30 m [53]	30 m [53]
Is a system available for postprocessing data?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
U.S. SUGGESTED LIST PRICE (\$)							
Receiver?	Call for best pricing	Call for best pricing	Call for best pricing	Call for best pricing	Contact Topcon dealer	Call for best pricing	From \$4,500
Antenna?	Call for best pricing	Call for best pricing	Call for best pricing	Call for best pricing	Call for best pricing	Call for best pricing	From \$2,195
Postprocessing hardware and software?	Call for best pricing	Call for best pricing	Call for best pricing	N/A	Call for best pricing	Call for best pricing	\$2,000 to \$8,000
WARRANTY (months)							
Receiver?	12 months limited	12 months limited					
Antenna?	12 months limited	Yes	12	12	12	12	12
Postprocessing hardware?	12 months limited	Yes	12	12	12	12	12
ADVANCED FEATURES	[38]		[39][40]	[39]	[51]	[52]	[54]

2005 GPS Equipment Survey—Geodetic Receivers

MANUFACTURER/DISTRIBUTOR	Topcon Hiper Pro 800/443-4567	Topcon Hiper + 800/443-4567	Topcon Hiper Lite+ 800/443-4567	Topcon Odyssey RS 800/443-4567	Topcon GB-1000 800/443-4567	Topcon GB-500 800/443-4567
Receiver tracking characteristics						
Single-frequency or dual-frequency GPS?	Dual	Dual	Dual	Dual	Dual	Dual
L1 C/A code, L1 carrier						
L1 only, codeless						
L1 only, C/A-code						
L1 codeless and L2 codeless						
L1 C/A-code and L2 codeless						
L1 C/A-code and P-code, L2 P-code						
L1 C/A-code and L2 P-code						
Other						
GLONASS?	Yes	Yes	Yes	Yes	Yes	Yes
WAAS?	Yes	Yes	Yes	Yes	Yes	Yes
Max. number of satellites tracked simultaneously	20	20	20	20	20	20
Number of receiver channels	40	40	40	40	40	40
Selectable data interval for phase measurement?	1 to 20 H	1 to 20 H	1 to 20 H	1 to 20 H	1 to 20 H	1 to 20 H
When four satellites are tracked, does the receiver display provide:						
Satellite tracking status?	Yes	Yes	Yes	Yes	Yes	Yes
Coordinated Universal Time (UTC)?	Yes [42]	Yes [42]	Yes [42]	Yes [42]	Yes [42]	Yes [42]
Three-dimensional positions?	Yes [42]	Yes [42]	Yes [42]	Yes [42]	Yes [42]	Yes [42]
Velocity?	Yes [42]	Yes [42]	Yes [42]	Yes [42]	Yes [42]	Yes [42]
Dilution of precision?	Yes [42]	Yes [42]	Yes [42]	Yes [42]	Yes [42]	Yes [42]
Real-time map display with linework and background	No	No	No	No	No	No
Touch screen display?	No	No	No	No	No	No
Coordinates in grid, local or ground values? If yes, state which.	Yes [42]	Yes [42]	Yes [42]	Yes [42]	Yes [42]	Yes [42]
Horizontal Accuracy (Std. Dev.)						
Static (cm)	[44]	[44]	[45]	[44]	[44]	[44]
RTK (cm)	[46]	[46]	[47]	[46]	[46]	[46]
Does the receiver accurately measure and output:						
Code Phase?	Yes	Yes	Yes	Yes	Yes	Yes
Carrier Phase?	Yes	Yes	Yes	Yes	Yes	Yes
Integrated Doppler?	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo-range data?	Yes	Yes	Yes	Yes	Yes	Yes
Full wavelength L2 carrier-phase data when A/S is implemented?	Yes	Yes	Yes	Yes	Yes	Yes
Cross-correlated Y2 - Y1 pseudoranges?	Yes	Yes	Yes	Yes	Yes	Yes
Other dual-frequency technology	Yes	Yes	Yes	Yes	Yes	Yes
Specify available observables (e.g. L1 C/A, L1 Phase, etc.)	[48]	[48]	[48]	[48]	[48]	[48]
On what medium is observed data recorded during the observations?						
Internal memory?	Yes	Yes	Yes	Yes	Yes	Yes
Other medium?	Yes (external PC)	Yes (external PC)	Yes (external PC)	Yes (external PC)	[61]	Yes (external PC)
If recorded in the internal memory, what medium is available to transfer to after the observations end? (serial port, IR port, USB port, removable media memory, other)	Serial, USB	Serial, USB	Serial, USB	Serial, USB, IR, Ethernet	Serial, USB, Ethernet	Serial, USB
Maximum internal memory capacity (Mb)	1000	Up to 1000	1000	1000	Up to 1000	Up to 1000
Maximum data transfer speed from internal memory to PC (baud)	Up to 460800	Up to 460800	Up to 460800	Up to 460800	Up to 460800	Up to 460800
RECEIVER INTERFACE						
Are the following supported on the single component of the system, which includes the Receiver (Rx), or the controller or handheld computer (C) or both (B).						
Alpha-numeric entry of data						
Text warnings	C	C	C	C	C	C
Setting of receiver parameters	C	C	C	C	Rx	C
Receiver status	B	B	B	B	Rx	B
Messages formed with LEDs	B	B	B	B	Rx	B
Messages formed with LCDs	Rx	Rx	Rx	Rx	Rx	Rx
Can receiver be used in a vehicle for positioning and navigation?	C	C	C	C	Rx	C
Can the receiver perform:	Yes	Yes	Yes	Yes	Yes	Yes
Kinematic surveys?	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo-kinematic surveys?	Yes	Yes	Yes	Yes	Yes	Yes
Rapid static surveys?	Yes	Yes	Yes	Yes	Yes	Yes
Can the receiver perform real-time kinematic surveys?	Yes	Yes	Yes	Yes	Yes	Yes
If yes, does it have on-the-fly ambiguity resolution capabilities?	Yes	Yes	Yes	Yes	Yes	Yes
Is RTK radio internal or external?	Internal	Internal	Internal (spread spectrum)	Internal or external	External	External
Use of multiple RTK base stations on a single radio	Yes	Yes	Yes	Yes	Yes	Yes
Can the receiver perform real-time Differential GPS (DGPS)?	Yes	Yes	Yes	Yes	Yes	Yes
Is the receiver capable of picking up signals from U.S. Coast Guard beacons?	Yes [49]	Yes [49]	Yes [49]	Yes [49]	Yes [49]	Yes [49]
Is the receiver capable of picking up signals from the commercially available DGPS service companies?	Yes [50]	Yes [50]	Yes [50]	Yes [50]	Yes [50]	Yes [50]
Time to first satellite signal lock (seconds)	<1	1	<1	<1	<1	<1
For all available satellites? (seconds)	10	<10	10	10	10	10
Can the system be preprogrammed or initialized with session observing criteria at an office before going to the sites?	Yes	Yes	Yes	Yes	Yes	Yes
If yes, can the system be programmed with information for multiple sessions?	Yes	Yes	Yes	Yes	Yes	Yes
If the system can be preprogrammed, can alphanumeric data be input?	Yes	Yes	Yes	Yes	Yes	Yes
Does the receiver give some indication that data is being recorded?	Yes	Yes	Yes	Yes	Yes	Yes
Size: (H x W x D)	6.75 x 6.25 x 3.5	6.75 x 6.25 x 3.5	6.75 x 6.25 x 3.5	9.53 x 6.25 x 1.93	5.9 x 10.1 x 2.5	10.1 x 5.9 x 2.5
Weight: (lbs. Receiver only)	3.6	3.6	3.6	4.19	2.2	2.2
Is antenna included in the weight?	Yes	Yes	Yes	No	No	No
Weight (lbs. Complete RTK rover-receiver, antenna, controller, radio, pole, batteries)	Approx. 5	Approx. 5	Approx. 5	Approx. 6	Approx. 5	Approx. 5
Receiver housing material (e.g. plastic, metal)	Aluminum/plastic	Aluminum/plastic	Aluminum/plastic	Aluminum	Plastic	Plastic
Humidity proofing (e.g. 95%, 100% non-condensing)		Waterproof	Waterproof	Waterproof	100%	100%
Drop height survival (m/ft)					2 m	2 m
Waterproofing (e.g. IPX5, IPX6, IPX7)					IP66	IP66
Operating Temperature Range (degrees F/C)	-40 to 55°C	-40 to 55°C	-40 to 55°C	-40 to 55°C	-20 to 55°C	-20 to 55°C
Is standard battery internal?	Yes	Yes	Yes	Yes	Yes	Yes
Hours of operation at 0 degrees C with standard battery	> 8	>12	> 10 with TX on	20	7	7
Input voltage range (v)	6-28	6 to 28	6-28	6 to 28	6 to 28	6-28
Power consumption? (watts, receiver only)	<5	<3.3	<5	<3	<4	<4
Power consumption? (watts complete RTK rover inc. receiver, antenna, radio, controller)	<6	<4	<5	<4.3	<5	<5
Has the system (including all components) been tested by the (FGCS)*?	No	No	No	No	No	No
ANTENNA						
Type:	Microstrip	Microstrip	Microstrip	[59]	PG-A1 (zero centered)	PG-A1 (zero centered)
Is antenna built into the receiver?	Yes	Yes	Yes	No	No	No
If yes, is antenna removable?	No	No	No			
If it is not removable, is there a provision for an external antenna?	Yes (optional)	Yes (optional)	Yes (optional)			
Weight, antenna (lbs.)	1	1	1	1	1	1
Length of antenna cable furnished with receiver?				3 m	1 m	3 m
Maximum length of antenna cable that can be used?	30 m	30 m [53]	30 m [53]	30 m [53]	30 m [53]	30 m [53]
Is a system available for postprocessing data?	Yes	Yes	Yes	Yes	Yes	Yes
U.S. SUGGESTED LIST PRICE (\$)						
Receiver?		\$8,100+	\$13,700		\$6,000+	\$5500+
Antenna?			Included		\$2,195+	\$2195+
Postprocessing hardware and software?		\$2,000 to \$8,000	\$2,000 to \$3,500	\$2,000 to \$8,000	\$2,000 to \$8,000	\$2,000 to \$8,000
WARRANTY (months)						
Receiver?	12	12	12	12	12	12
Antenna?	12	12	12	12	12	12
Postprocessing hardware?						
ADVANCED FEATURES	[55]	[56][57]	[56][58]	[60]	[62]	[63]

2005 GPS Equipment Survey—Geodetic Receivers

MANUFACTURER/DISTRIBUTOR	Trimble	Trimble	Trimble	Trimble	Trimble	Trimble
RECEIVER MODEL	Trimble 4600LS	Trimble 5700	Trimble 5800	Trimble R7	Trimble R8	Trimble NetRS
Manufacturer's phone number						
Receiver tracking characteristics						
Single-frequency or dual-frequency GPS?	Single	Dual	Dual	Dual	Dual	Dual
L1 C/A code, L1 carrier						
L1 only, codeless						
L1 only, C/A-code						
L1 codeless and L2 codeless						
L1 C/A-code and L2 codeless						
L1 C/A-code and P-code, L2 P-code						
L1 C/A-code and L2 P-code						
Other	[64]	[64][77]	[64][77]	[93]	[93]	[93]
GLONASS?	No	No	No	No	No	No
WAAS?	No	Yes	Yes	Yes	Yes	Yes
Max. number of satellites tracked simultaneously	12	12	12	12	12	12
Number of receiver channels	12	24	24	24	24	24
Selectable data interval for phase measurement?	Yes [65]	Yes [78]	Yes [78]	Yes [78]	Yes [78]	Yes [78]
When four satellites are tracked, does the receiver display provide:						
Satellite tracking status?	Yes	Yes	Yes	Yes	Yes	Yes
Coordinated Universal Time (UTC)?	Yes [66]	Yes [66]	Yes [66]	Yes [66]	Yes [66]	Yes [95]
Three-dimensional positions?	Yes [66]	Yes [66]	Yes [66]	Yes [66]	Yes [66]	Yes [95]
Velocity?	Yes [66]	Yes [66]	Yes [66]	Yes [66]	Yes [66]	N/A
Dilution of precision?	Yes [66]	Yes [66]	Yes [66]	Yes [66]	Yes [66]	Yes [95]
Real-time map display with linework and background	Yes [66]	Yes [66]	Yes [66]	Yes [66]	Yes [66]	N/A
Touch screen display?	Yes [66]	Yes [66]	Yes [66]	Yes [66]	Yes [66]	N/A
Coordinates in grid, local or ground values? If yes, state which.	Yes [67]	Yes [67]	Yes [67]	Yes [67]	Yes [67]	N/A
Horizontal Accuracy (Std. Dev.)						
Static (cm)	± 0.5 cm + 1 ppm RMS	± 0.5 cm + 0.5 ppm RMS	± 0.5 cm + 0.5 ppm RMS	± 0.5 cm + 0.5 ppm RMS	± 0.5 cm + 0.5 ppm RMS	± 0.5 cm + 0.5 ppm RMS
RTK (cm)	N/A	± 1.0 cm + 1 ppm RMS	± 1.0 cm + 1 ppm RMS	± 1.0 cm + 1 ppm RMS	± 1.0 cm + 1 ppm RMS	N/A
Does the receiver accurately measure and output:						
Code Phase?	Yes	Yes	Yes	Yes	Yes	Yes
Carrier Phase?	Yes	Yes	Yes	Yes	Yes	Yes
Integrated Doppler?	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo-range data?	Yes	Yes	Yes	Yes	Yes	Yes
Full wavelength L2 carrier-phase data when A/S is implemented?	N/A	Yes	Yes	Yes	Yes	Yes
Cross-correlated Y2 - Y1 pseudoranges?	N/A	Yes	Yes	Yes	Yes	Yes
Other dual-frequency technology	N/A	Yes	Yes	Yes	Yes	Yes
Specify available observables (e.g. L1 C/A, L1 Phase, etc.)	Note 5	[79]	[79]	[79]	[79]	[79]
On what medium is observed data recorded during the observations?	Internal RAM memory	Removable Compact Flash	Internal RAM memory	Removable Compact Flash	Internal RAM memory	Internal RAM memory
Internal memory?	Internal RAM memory	Removable Compact Flash	Internal RAM memory	Removable Compact Flash	Internal RAM memory	Internal RAM memory
Other medium?	[68]	[68]	[68]	[68]	[68]	Direct to PC
If recorded in the internal memory, what medium is available to transfer to after the observations end? (serial port, IR port, USB port, removable media memory, other)	[69]	[80]	[69]	[80]	[69]	[96]
Maximum internal memory capacity (Mb)	1 MB [70]	Varies [81]	2 MB [89]	Varies [81]	6 MB [94]	150 MB [97]
Maximum data transfer speed from internal memory to PC (baud)	38400	USB: 1 Megabit/sec	115200	USB: 1 Megabit/sec	115200	Ethernet
RECEIVER INTERFACE						
Are the following supported on the single component of the system, which includes the Receiver (Rx), or the controller or handheld computer (C) or both (B).						
Alpha-numeric entry of data	C	C	C	C	C	Computer
Text warnings	C	C	C	C	C	Computer
Setting of receiver parameters	B	B	C	B	B	Computer
Receiver status	B	B	B	B	B	Rx and Computer
Messages formed with LEDs	Rx	Rx	Rx	Rx	Rx	Rx
Messages formed with LCDs	C	C	C	C	C	Computer
Can receiver be used in a vehicle for positioning and navigation?	Yes	Yes	Yes	Yes	Yes	N/A
Can the receiver perform:						
Kinematic surveys?	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo-kinematic surveys?	Yes	Yes	Yes	Yes	Yes	Yes
Rapid static surveys?	N/A	Yes	Yes	Yes	Yes	Yes [98]
Can the receiver perform real-time kinematic surveys?						
If yes, does it have on-the-fly ambiguity resolution capabilities?		Yes, both available	Yes, both available	Yes, both available	Yes, both available	
Is RTK radio internal or external?		Yes	Yes	Yes	Yes	
Use of multiple RTK base stations on a single radio	N/A	Yes	Yes	Yes	Yes	Yes [98]
Can the receiver perform real-time Differential GPS (DGPS)?						
Is the receiver capable of picking up signals from U.S. Coast Guard beacons?		Yes	Yes	Yes	Yes	
Is the receiver capable of picking up signals from the commercially available DGPS service companies?		Yes	Yes	Yes	Yes	
Time to first satellite signal lock (seconds)		<10 sec	<10 sec	<10 sec	<10 sec	<10 sec
For all available satellites? (seconds)		<30 sec	<30 sec	<30 sec	<30 sec	<30 sec
Can the system be preprogrammed or initialized with session observing criteria at an office before going to the sites?	Yes	Yes	Yes	Yes	Yes	Yes
If yes, can the system be programmed with information for multiple sessions?	Controlled by data collector	Yes	Controlled by data collector	Yes	Controlled by data collector	Yes
If the system can be preprogrammed, can alphanumeric data be input?	Yes	Yes	Yes	Yes	Yes	Yes
Does the receiver give some indication that data is being recorded?	Yes, Color LED indication	Yes, Color LED indication	Yes, Color LED indication	Yes, Color LED indication	Yes, Color LED indication	Yes, Color LED indication
Size: (H x W x D)	[71]	[82]	[90]	[82]	[90]	[99]
Weight: (lbs. Receiver only)	[72]	[83]	[91]	[83]	[91]	[100]
Is antenna included in the weight?	Yes	No, varies [84]	Yes	No, varies [84]	Yes	No, varies [84]
Weight (lbs. Complete RTK rover-receiver, antenna, controller, radio, pole, batteries)	N/A	[85]	[92]	[85]	[92]	[98]
Receiver housing material (e.g. plastic, metal)	Hardened plastic	Magnesium alloy	Hardened plastic	Magnesium alloy	Hardened plastic	Composite metal extrusion
Humidity proofing (e.g. 95%, 100% non-condensing)	[73]	[73]	[73]	[73]	[73]	[73]
Drop height survival (m/ft)	[74]	[86]	[74]	[86]	[74]	[74]
Waterproofing (e.g. IPX5, IPX6, IPX7)	MIL-SPEC-810E	IPX7	IPX7	IPX7	IPX7	IPX5
Operating Temperature Range (degrees F/C)	-40 to 65°C (-40 to 149°F)	-40 to 65°C (-40 to 149°F)	-40 to 65°C (-40 to 167°F)	-40 to 65°C (-40 to 149°F)	-40 to 65°C (-40 to 149°F)	-40 to 65°C (-40 to 149°F)
Is standard battery internal?	Yes	Yes	Yes	Yes	Yes	No
Hours of operation at 0 degrees C with standard battery	[75]	[87]	[87]	[87]	[87]	24/7 [98]
Input voltage range (v)	9 VDC - 20 VDC	11V - 28V DC (ports 2,3)	11V - 28V DC (ports 1)	11V - 28V DC (ports 2,3)	11V - 28V DC (ports 1)	11V - 28V DC
Power consumption? (watts, receiver only)	<1 Watt	2.5 Watts	<2.5 Watts	2.5 Watts	<2.5 Watts	[101]
Power consumption? (watts complete RTK rover inc. receiver, antenna, radio, controller)	N/A	3.75 Watts	<3.75 Watts	3.75 Watts	<3.75 Watts	[98]
Has the system (including all components) been tested by the (FGCS)*?	Yes	Yes	See Trimble 5700	See Trimble 5700	See Trimble 5700	No
ANTENNA						
Type:	4600LS Internal	Varies [84]	5800 Internal	Varies [84]	Trimble R8 Internal	Varies [84]
Is antenna built into the receiver?	Yes	No	Yes	No	No	No
If yes, is antenna removable?	No	N/A	No	N/A	No	N/A
If it is not removable, is there a provision for an external antenna?	No	N/A	No	N/A	No	N/A
Weight, antenna (lbs.)	Included in receiver weight	Varies [84]	Included in receiver weight	Varies [84]	Included in receiver weight	Varies [84]
Length of antenna cable furnished with receiver?	Cable free	10 m (30 ft)	Cable free	10 m (30 ft)	Cable free	10 m (30 ft)
Maximum length of antenna cable that can be used?	Cable free	[88]	Not required	[88]	Not required	[88]
Is a system available for postprocessing data?	Yes	Yes	Yes	Yes	Yes	Yes
U.S. SUGGESTED LIST PRICE (\$) Receiver?	Contact Trimble dealer	Contact Trimble dealer	Contact Trimble dealer	Contact Trimble dealer	Contact Trimble dealer	Contact Trimble dealer
Antenna?	Contact Trimble dealer	Contact Trimble dealer	Contact Trimble dealer	Contact Trimble dealer	Contact Trimble dealer	Contact Trimble dealer
Postprocessing hardware and software?	Contact Trimble dealer	Contact Trimble dealer	Contact Trimble dealer	Contact Trimble dealer	Contact Trimble dealer	Contact Trimble dealer
WARRANTY (months)						
Receiver?	12	12	12	12	12	12
Antenna?	12	12	12	12	12	12
Postprocessing hardware?	12	12	12	12	12	12
ADVANCED FEATURES	[76]	[76]	[76]	[76]	[76]	[76]

2005 GPS Equipment Survey—Mapping/Positioning Receivers

MANUFACTURER/DISTRIBUTOR	Leica Geosystems	Leica Geosystems	Leica Geosystems	NavCom Technology Inc.	NavCom Technology Inc.	SOKKIA	SOKKIA
RECEIVER MODEL	GS20 PDM	GS5+	GS5	SF-2040G	SF-2050G	GSR2650 LB	Axis3
Manufacturer's Phone Number	800/367-9453	800/367-9453	800/367-9453	310/381-2000	310/381-2000	800/255-3913	800/255-3913
Receiver tracking characteristics							
L1 C/A code, L1 carrier	Yes	Yes	Yes	Yes	Yes		
L1 only, C/A-code	Yes	Yes	Yes				Yes
L1 codeless and L2 codeless	No	No	No				
Other	Integrated WAAS tracking			P1, L2 Phase, P2	P1, L2 Phase, P2	L1/L2 code and carrier	
Max. number of satellites tracked simultaneously	12	12	12	12 GPS + 2 SBAS	12 GPS + 2 SBAS	12 + OmniStar	12
Number of receiver channels	12	12	12	24 GPS + 2 SBAS	24 GPS + 2 SBAS	25	12
When four satellites are tracked, does the receiver display provide:							
Coordinated Universal Time (UTC)?	Yes	Yes	Yes	Yes [4]	Yes [4]	[8]	[8]
Three-dimensional positions?	Yes	Yes	Yes	Yes [4]	Yes [4]	[8]	[8]
Velocity?	Yes	Yes	Yes	Yes [4]	Yes [4]	[8]	[8]
Dilution of precision?	Yes	Yes	Yes	Yes [4]	Yes [4]	[8]	[8]
Graphical display indicating GPS/DGPS status?	Yes	Yes	Yes	Yes [4]	Yes [4]	[8]	[8]
Horizontal Accuracy (Std. Dev.)							
Post-processed differential (m)	0.3 m 2D rms	N/A	N/A	.005 + 1 ppm	.005 + 1 ppm		0.5 (2DRMS)
Real-time differential (m)	0.4 m 2D rms	<1 m	1-2 m	0.1	0.1	[35]	<1 (2DRMS)
Does the receiver accurately measure and output:							
Code Phase?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Carrier Phase?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Integrated Doppler?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo-range data?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Full wavelength L2 carrier-phase data when A/S is implemented?	No	No	No	Yes	Yes	Yes	No
Cross-correlated Y2 - Y1 pseudorange?	No	No	No	No	No	No	No
Other dual-frequency technology	No	No	No	Yes	Yes	Yes	No
On what medium is observed data recorded during the observations?							
Internal memory?	Compact Flash	Flash card	Flash card				
Other medium?	No	No	N/A	Yes	Yes	No	No
				Serial to PC/PDA	Serial to PC/PDA	Serial to PC/PDA	Handheld controller
Can the receiver perform real-time Differential GPS (DGPS)?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Is the receiver capable of picking up signals from U.S. Coast Guard beacons?	Yes	Yes	Any RTCM	No	No	No	Yes
Is the receiver capable of picking up signals from the commercially available DGPS service companies?	Yes		Any RTCM	Yes, StarFire	Yes, StarFire	Yes, OmniStar	Yes, OmniStar
Is receiver capable of using WAAS corrections?	Yes	No	No	Yes	Yes	Yes	Yes
To lock on the GPS signals, does the system require a reference position?	No, but recommended	No	No	No	No	No	No
If Yes, how accurate (e.g., 100m, 30km, etc.):							
Horizontal position?							
Vertical position?							
Time to first satellite signal lock? (seconds)	10	10	10	30	30		
For all available satellites? (seconds)	45	45	45	<60	<60		<60
Can the system be preprogrammed or initialized with session observing criteria at an office before going to the sites?	Yes		N/A	No	No	No	No
If Yes, can the system be programmed with information for multiple sessions?	Yes						
Size: (H x W x D)	8.46 x 3.54 x 1.97	3.5 x 5.5 x 5.5	3.5 x 5.5 x 5.5	5.5 H x 10.4 D	3.1 x 5.7 x 8.2	2.8 x 6.0 x 7.1	2.0 x 4.9 x 7.4
Number of serial ports	1 + 2 via Bluetooth	1	1	2	2	3	2
Material receiver is constructed of	Polycarbonate	Plastic composite	Plastic composite	Alloy/UV stable plastic	Alloy	Aluminum	
Weight: (lbs.)	1.44	1.45	0.86	5.5	4	2.4	1.68
Is antenna included in the weight?	Yes	Yes	Yes	Yes	Yes	No	No
Weight: (lbs. Complete RTK rover-receiver, antenna, controller, radio, pole, batteries)	1.44			[5]	[5]	Approx. 9	
ANTENNA							
Type:	Internal: Leica AT575	Integrated	Integrated	Drooped dipole	Drooped dipole	SK 600 LB PinWheel	Axis3 Antenna
Other?	External: Leica AT501	No		No	No		
Is antenna built into the receiver?	Yes	Yes	Yes	Yes	No	No	No
If Yes, is antenna removable?	No	No	No	No			
Weight, antenna (lbs.)				N/A	1	1.61	1.10
Length of antenna cable furnished with receiver?		1.8 m	1.8 m	N/A	10 ft	2.5 m	2.5 m
POSTPROCESSOR							
Is a system available for postprocessing data in the field?	Yes	No	No	Not required [6]	Not required [6]	No	Yes
U.S. SUGGESTED LIST PRICE (\$)	Contact Leica Geosystems	Contact Leica Geosystems	Contact Leica Geosystems				
Receiver?	Contact Leica Geosystems	Contact Leica Geosystems	Contact Leica Geosystems			Contact SOKKIA	Contact SOKKIA
Antenna?	Contact Leica Geosystems	N/A	N/A			Contact SOKKIA	Contact SOKKIA
Postprocessing hardware and software?	Contact Leica Geosystems	N/A	N/A			Contact SOKKIA	Contact SOKKIA
Postprocessing software (only)?	Contact Leica Geosystems	N/A	N/A			Contact SOKKIA	Contact SOKKIA
WARRANTY (months)	12	12	12				
Receiver?	12	12	12	12	12	12	12
Antenna?	12	12	12	12	12	12	12
Postprocessing hardware?	12	N/A					Updates free
ADVANCED FEATURES	[1]	[2]	[2][3]	[6]	[6]	OmniStar HP capable	

2005 GPS Equipment Survey—Mapping/Positioning Receivers

MANUFACTURER/DISTRIBUTOR	Thales Navigation	Thales Navigation	Thales Navigation	Thales Navigation	Thales Navigation	Topcon	Topcon
RECEIVER MODEL	MobileMapper CE	MobileMapper Pro	Aquarius	3011	Sagitta	GMS-200	GMS-2
Manufacturer's Phone Number	800/922-2401	800/922-2401	800/922-2401	800/922-2401	800/922-2401	800/443-4567	800/443-4567
Receiver tracking characteristics							
L1 C/A code, L1 carrier	Yes	Yes	L1-L2	L1	L1-L2	Yes	Yes
L1 only, C/A-code	Yes	Yes	L1-L2	Yes	L1-L2		
L1 codeless and L2 codeless	No	No	L1-L2		L1-L2		
Other	WAAS/EGNOS, RTCM	No		[16]		[18]	[19]
Max. number of satellites tracked simultaneously	14	12	56	12	12	20	50
Number of receiver channels	14	12	2	1	2	40	50
When four satellites are tracked, does the receiver display provide:							
Coordinated Universal Time (UTC)?	Yes	Yes		Yes		Yes	Yes
Three-dimensional positions?	Yes	Yes		Yes		Yes	Yes
Velocity?	Yes	Yes		Yes		Yes	Yes
Dilution of precision?	Yes	Yes				Yes	Yes
Graphical display indicating GPS/DGPS status?	Yes	Yes		Optional		Yes	Yes
Horizontal Accuracy (Std. Dev.)							
Post-processed differential (m)	N/A	<1 m		0.5 m RMS		5 mm + 2 ppm	5 mm + 2 ppm
Real-time differential (m)	Submeter	2-3 m	RTK 5 mm		RTK 5 mm	Decimeter	Submeter
Does the receiver accurately measure and output:							
Code Phase?	Yes	Yes				Yes	Yes
Carrier Phase?	Yes	Yes				Yes	Yes
Integrated Doppler?	No	No				Yes	Yes
Pseudo-range data?	No	Yes				Yes	Yes
Full wavelength L2 carrier-phase data when A/S is implemented?	N/A	No				Yes	N/A
Cross-correlated Y2 - Y1 pseudoranges?	N/A	No				Yes	N/A
Other dual-frequency technology	N/A	No				[19]	[23]
On what medium is observed data recorded during the observations?							
Internal memory?	Yes	Yes		Yes		Yes	Yes
Other medium?	SD card	SD card				[20]	SD memory slot
Can the receiver perform real-time Differential GPS (DGPS)?							
Is the receiver capable of picking up signals from U.S. Coast Guard beacons?	Yes [10]	Yes	Yes	Optional	Optional	Yes	Yes, with BR-1
Is the receiver capable of picking up signals from the commercially available DGPS service companies?	Yes	Yes	Yes	Yes	Yes	Yes, OmnistarHP	No
Is receiver capable of using WAAS corrections?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
To lock on the GPS signals, does the system require a reference position?							
If Yes, how accurate (e.g., 100m, 30km, etc.):							
Horizontal position?		No	No	No	No		
Vertical position?							
Time to first satellite signal lock? (seconds)	15	15	30	80	30	1	< 1
For all available satellites? (seconds)	15	15	30	80	30	10	< 10
Can the system be preprogrammed or initialized with session observing criteria at an office before going to the sites?							
If Yes, can the system be programmed with information for multiple sessions?		No	Yes	No	Yes	Yes	Yes
Size: (H x W x D)	7.7 x 3.5 x 1.8	6.5 x 2.9 x 1.2	5 x 9.5 x 12	10 x 2.5 x 8.5	10 x 2.5 x 8.5	6.8 x 6.3 x 3.5	197 x 90 x 65 mm
Number of serial ports	1	1	4	4	4	2 (4 optional)	2
Material receiver is constructed of	[11]	Polymer	Aluminum	Aluminum	Aluminum	Aluminum/plastic	Plastic/aluminum
Weight: (lbs.)	1.01	0.48	9.26	4	4	3	0.7 kg
Is antenna included in the weight?	Yes	Yes	No	No	No	No	Yes
Weight: (lbs. Complete RTK rover-receiver, antenna, controller, radio, pole, batteries)	N/A	N/A				Approx. 5	
ANTENNA							
Type:	Patch	Quadrifilar	L1-L2	Jewel L1	L1-L2	[21]	Integrated
Other?	[12]	Optional patch					PG-A1
Is antenna built into the receiver?	Yes	Yes	No	No	No	No	Yes
If Yes, is antenna removable?	No	No					No
Weight, antenna (lbs.)	N/A		.77	4.5	0.77	1.1	
Length of antenna cable furnished with receiver?	N/A	N/A	10 m	30 m	10 m	1 m	N/A
POSTPROCESSOR							
Is a system available for postprocessing data in the field?	N/A	Yes		No	No	Yes	Yes
U.S. SUGGESTED LIST PRICE (\$)	\$2,195	\$1,795					
Receiver?	\$2,195	Included in price				Contact Topcon dealer	Contact Topcon dealer
Antenna?	N/A	Included in price				Contact Topcon dealer	Contact Topcon dealer
Postprocessing hardware and software?	N/A	Yes				Contact Topcon dealer	Contact Topcon dealer
Postprocessing software (only)?	N/A	MobileMapper Office				Contact Topcon dealer	Contact Topcon dealer
WARRANTY(months)							
Receiver?	12	12	12	12	12	12	12
Antenna?	12	12	12	12	12	12	12
Postprocessing hardware?	N/A	N/A	12	12	12	12	12
ADVANCED FEATURES	[13]	[14]	[15]	[17]	[15]	[22]	[24]

2005 GPS Equipment Survey—Mapping/Positioning Receivers

MANUFACTURER/DISTRIBUTOR	Topcon	Trimble	Trimble	Trimble	Trimble	Trimble
RECEIVER MODEL	GMS-110	GeoXM	GPS Pathfinder Power	GPS Pathfinder Pro XRS	GeoXT	GPS Pathfinder Pro XR
Manufacturer's Phone Number	800/443-4567	720/887-4374	720/887-4374	720/887-4374	720/887-4374	720/887-4374
Receiver tracking characteristics						
L1 C/A code, L1 carrier	Yes		Yes	Yes	Yes	Yes
L1 only, C/A-code		Yes				
L1 codeless and L2 codeless						
Other	WAAS/EGNOS					
Max. number of satellites tracked simultaneously	20	8	12	12	12	12
Number of receiver channels	40	8	12	12	12	12
When four satellites are tracked, does the receiver display provide:						
Coordinated Universal Time (UTC)?	Yes	Yes	Yes	Yes	Yes	Yes
Three-dimensional positions?	Yes	Yes	Yes	Yes	Yes	Yes
Velocity?	Yes	Yes	Yes	Yes	Yes	Yes
Dilution of precision?	Yes	Yes	Yes	Yes	Yes	Yes
Graphical display indicating GPS/DGPS status?	Yes	Yes	Yes	Yes	Yes	Yes
Horizontal Accuracy (Std. Dev.)						
Post-processed differential (m)	Yes	2-5 m	Submeter	50cm	Submeter	50 cm
Real-time differential (m)	Yes	2-5 m	Submeter	Submeter	Submeter	Submeter
Does the receiver accurately measure and output:						
Code Phase?	Yes	Yes	Yes	Yes	Yes	Yes
Carrier Phase?	Yes	N/A	Yes	Yes	Yes	Yes
Integrated Doppler?	Yes	N/A	Yes	Yes	Yes	Yes
Pseudo-range data?	Yes	N/A	Yes	Yes	Yes	Yes
Full wavelength L2 carrier-phase data when A/S is implemented?	Yes	N/A	N/A	N/A	N/A	N/A
Cross-correlated Y2 - Y1 pseudoranges?	Yes	N/A	N/A	N/A	N/A	N/A
Other dual-frequency technology		N/A	N/A	N/A	N/A	N/A
On what medium is observed data recorded during the observations?		Non-volatile Flash	[31]	[31]	Non-volatile Flash	[31]
Internal memory?	128 MB	Yes	[31]	[31]	Yes	[31]
Other medium?	[25]	No	[31]	[31]		[31]
Can the receiver perform real-time Differential GPS (DGPS)?	Yes	Yes	Yes	Yes	Yes	Yes
Is the receiver capable of picking up signals from U.S. Coast Guard beacons?	Yes	Yes [28]	No	Yes	Yes [28]	Yes
Is the receiver capable of picking up signals from the commercially available DGPS service companies?	Yes	No	Yes	Yes	No	No
Is receiver capable of using WAAS corrections?	Yes	Yes	Yes	Yes	Yes	Yes
To lock on the GPS signals, does the system require a reference position?		No	No	No	No	No
If Yes, how accurate (e.g., 100m, 30km, etc.):	No					
Horizontal position?						
Vertical position?						
Time to first satellite signal lock? (seconds)	1	<15 typical	<15 typical	<15 typical	<15 typical	<15 typical
For all available satellites? (seconds)	10	<30 typical	<30 typical	<30 typical	<30 typical	<30 typical
Can the system be preprogrammed or initialized with session observing criteria at an office before going to the sites?	Yes	Yes	N/A	N/A	N/A	N/A
If Yes, can the system be programmed with information for multiple sessions?	Yes	Yes				
Size: (H x W x D)	6.8 x 6.3 x 3.5	8.5 x 3.9 x 3.0	5 x 6 x 6	4.4 x 2.0 x 7.7	8.5 x 3.9 x 3.0	4.4 x 2.0 x 7.7
Number of serial ports	Up to 4	1 [29]	2	2	1 [29]	2
Material receiver is constructed of	Aluminum	Xenoy/magnesium	Xenoy	Alloy	Xenoy/magnesium	Alloy
Weight: (lbs.)	3	1.59	1.38	1.68	1.59	1.68
Is antenna included in the weight?	No	Yes	Yes	No	Yes	No
Weight: (lbs. Complete RTK rover-receiver, antenna, controller, radio, pole, batteries)	Approx. 5	N/A	N/A			N/A
ANTENNA						
Type:	[26]	Integrated	[32]	[33]	Integrated	[34]
Other?		[30]			[30]	
Is antenna built into the receiver?	No	Yes	Yes	No	Yes	No
If Yes, is antenna removable?		No	N/A		No	
Weight, antenna (lbs.)		N/A	N/A	1.2	N/A	1.08
Length of antenna cable furnished with receiver?	1.2 m	N/A	N/A	3 m	N/A	3 m
POSTPROCESSOR						
Is a system available for postprocessing data in the field?	Yes	Yes	Yes	Yes	Yes	Yes
U.S. SUGGESTED LIST PRICE (\$)	\$5,795	Contact dealer	Contact dealer	Contact dealer	Contact dealer	Contact dealer
Receiver?	Yes	Contact dealer	Contact dealer	Contact dealer	Contact dealer	Contact dealer
Antenna?	Yes	Contact dealer	Contact dealer	Contact dealer	Contact dealer	Contact dealer
Postprocessing hardware and software?	Yes	Contact dealer	Contact dealer	Contact dealer	Contact dealer	Contact dealer
Postprocessing software (only)?	Yes	Contact dealer	Contact dealer	Contact dealer	Contact dealer	Contact dealer
WARRANTY(months)		12		12	12	12
Receiver?	12	12	12	12	12	12
Antenna?	12	12	12	12	12	12
Postprocessing hardware?		N/A	N/A	N/A	N/A	N/A
ADVANCED FEATURES	[27]					

2005 GPS Post-processing Software Survey

Product Name	TurboSurvey Software 2	TurboSurvey Software 2, Static Only	SKI Pro Version 3.0	LEICA GEO Office	SPIDER	Spectrum Survey Suite	STAR*NET-PRO V6
Manufacturer/Distributor	ITT Industries	ITT Industries	Leica Geosystems	Leica Geosystems	Leica Geosystems	SOKKIA	Starplus Software, Inc.
Manufacturer's phone number	805/495-8420	805/495-8420	800/367-9453	800/367-9453	800/367-9453	800/255-3913	800/446-7848
Technical Support policy	[1]	[1]	[6]	[10]	[6]	Free support	[19]
Are Multi-License discounts available?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Can individual modules be purchased separately?	Call for details	Call for details	Yes	Yes	Yes	Yes	N/A
Are all features below supported in a single software package or are multiple packages required to achieve this? (# of packages required)	Single	Single	1	Single	No, 3	Product suite provided	Single
OPERATING SYSTEMS							
Windows systems (specify)	[2]	[2]	[7]	Win 98/2000/XP	[13]	[17]	95/98/NT/2000/XP
Other (specify)					none		
DATA INPUT							
Proprietary GPS data formats read (specify)	1	[4]	Leica	Leica		[18]	Most baseline formats
Handle RINEX files?	Yes	Yes	Yes	Yes	Generates and archives	Yes	
Edit capability (antenna info, station names, etc.)	Yes	Yes	Yes	Yes	Yes	Yes	Imported to text files
Maximum number of input files	None	None	NA	Unlimited	PC hard drive size	Unlimited	Unlimited
Maximum number of points or occupations	None	None	NA	Unlimited	PC harddrive size	Unlimited	10,000 stations currently
Proprietary Optical Total Station and level raw observation formats read (specify)	N/A	No	Leica	Leica	[14]	No	[20]
Import and display of background DXF maps and aerial orthophotos?	N/A	No	No	No	N/A	No	N/A
Import of National Geodetic Survey (NGS) data sheets in digital form?	No	No	No	No	Yes	No	[21]
PREPARATION OF PROCESSING NETWORK							
Presurvey planning?	Yes	Yes	Yes	Yes		Yes	N/A
Automatic arrangement of baselines?	Yes	Yes	Yes	Yes	[15]	Yes	
Auto arrangement of independent baselines only?	Yes	Yes	Yes	Yes	[15]	No	
User editing of occupation info after file loading?	Yes	Yes	Yes	Yes	[15]	Yes	
Manual solutions?	Yes	Yes	Yes	Yes	[15]	Yes	
Automatic Internet download of CORS data?	Yes	Yes	Yes	Yes	[15]	No	
BASELINE PROCESSING							
GLONASS processing available?	Yes	Yes	No	No	No	No	N/A
Can precise ephemeris data, when available, be input?	Yes	Yes	Yes	Yes	Yes	Yes	
Handle kinematic data or mixed with static?	Yes	No	Yes	Yes	[15]	Yes	
Initialize kinematic on-the-fly?	Yes	No	Yes	Yes		Yes	
Provide multiple solution types (triple difference, widelane) Specify.	[3]	[3]	Yes	[11]	[15]	Yes	
Results displayed in graphic form?	Yes	Yes	Yes	Yes	[15]	Yes	
Statistical quality factors available?	Yes	Yes	Yes	Yes	[15]	Yes	
Closure routines?	Yes	Yes	Yes	Yes	[15]	Yes	
Ability to configure quality control indicators?	Yes	Yes	Yes	Yes	Yes	Yes	
Will software process data from other manufacturers' receivers?	Yes	Yes	Yes, via RINEX	Yes, via RINEX	No	Yes	
COORDINATE TRANSFORMATION							
State Plane Coordinates?	Yes	Yes	Yes	Yes	N/A	Yes	Yes
UTM Coordinates?	Yes	Yes	Yes	Yes	N/A	Yes	Yes
User-definable datum and coordinate system?	Yes	Yes	Yes	Yes		Yes	Yes
Grid and ground coordinate system support?	Yes	Yes	Yes	Yes		Yes	Yes
LEAST-SQUARES ADJUSTMENT							
Available with processing package?	Yes	Yes	Yes	Yes	[15]	Yes	Yes [22]
If integrated, automatic geoid modeling?	Yes	Yes	No	Yes	[15]	Yes	Yes
Results displayed in graphic form?	Yes	Yes	Yes	Yes	[15]	Yes	Yes
Can adjust GPS, level and optical data together?	No	No	Yes	Yes	[15]	No	Yes
Able to define different weighting groups for different data types?	N/A	N/A	Yes	Yes	[15]	No	Yes
DATA EXPORT							
DXF output available?	Yes	Yes	Yes	Yes		No	Yes
Output RINEX files?	Yes	Yes	Yes	Yes	Yes	Yes	N/A
Formattable output files?	Yes	Yes	Yes	Yes	[15]	Yes	Yes
Export of National Geodetic Survey (NGS) Blue Book format report files?	Yes	Yes	Yes	Yes	[15]	No	
Export of reports in html format?	No	No	Yes	Yes	[15]	No	N/A
Export to proprietary design, CAD, survey and GIS formats? (specify)	No	No	Yes [8]	DXF, DWG, MapInfo	[15]	Yes	
GENERAL							
Integrated backup/restore?	No	No	Yes	Yes	Yes	No	
Integrated feature code processing, linework generation and CAD editing?	No	No	Yes, code processing	Yes	N/A	No	
Integrated contouring and DTM generation?	No	No	No	No	N/A	No	
Display as observations, features or both?	Yes	Both	Yes	Yes	[15]	Point names or features	
Automatic calc of combined scale factor?	Yes	Yes	Yes	Yes	[15]	Yes	Yes
Hardware lock, key disk, or other copyright protection?	Hardlock key	Hardlock key	Hardware Lock	Hardware Lock	Yes	Product activation key	H/W lock
Are all features above included as standard or are some sold as optional extras?	Standard	Kinematic is extra	Options	Some components optional	Yes	Standard	[23]
ADVANCED FEATURES							
U.S. SUGGESTED LIST PRICE (\$)	\$5,500	\$3,000	Contact Leica Geosystems	Contact Leica Geosystems	Contact Leica Geosystems	Contact SOKKIA	\$1,595
Are all software capabilities included in the price or are there additional upgrade modules?	All included	[5]	Contact Leica Geosystems	Contact Leica Geosystems	Yes	Contact SOKKIA	[23]
Are all software capabilities included in the price or are there additional upgrade modules?	Call for details	Call for details	Contact Leica Geosystems	Contact Leica Geosystems	Yes, contact Leica	Contact SOKKIA	[24]
Are update packages available to purchaser? If Yes, at what price? (U.S. \$)			[9]	[12]	[16]		z

2005 GPS Post-processing Software Survey

Product Name	Ashtech Solutions	GNSS Studio	MobileMapper Office	Pinnacle	Topcon Tools	Trimble Geomatics Office	Trimble Total Control
Manufacturer/Distributor	Thales Navigation	Thales Navigation	Thales Navigation	Topcon	Topcon	Trimble	Trimble
Manufacturer's phone number	800/922-2401	800/922-2401	800/922-2401	800/443-4567	800/443-4567	720/887-4374	720/887-4374
Technical Support policy	[25]	[25]	[25]	Free	Free	Contact Trimble dealer	Contact Trimble dealer
Are Multi-License discounts available?	Yes	Yes	No	Yes	Yes	Yes	Yes
Can individual modules be purchased separately?	Yes	Yes	N/A	Yes	Yes	Yes	No
Are all features below supported in a single software package or are multiple packages required to achieve this? (# of packages required)	Single package	Single	Single package	Single	Single	[36]	[36]
OPERATING SYSTEMS							
Windows systems (specify)	95/98/NT/XP/2000	95/98/NT/2000/XP	9x/Me/NT/XP/2000	[32]	98/Me/NT/2000/XP	Yes [37]	Yes [37]
Other (specify)			N/A				
DATA INPUT							
Proprietary GPS data formats read (specify)	Ashtech	[26]	MobileMapper	TPS/RINEX	TPS/RINEX	Yes [38]	Yes [41]
Handle RINEX files?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Edit capability (antenna info, station names, etc.)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Maximum number of input files	Unlimited	Unlimited	Unlimited	Unlimited	Unlimited	Unlimited	Unlimited
Maximum number of points or occupations	Unlimited	Unlimited	Unlimited	Unlimited	Unlimited	Unlimited	Unlimited
Proprietary Optical Total Station and level raw observation formats read (specify)	No	No	No	No	Yes [33]	Yes [39]	N/A
Import and display of background DXF maps and aerial orthophotos?	No	Yes	Yes	Yes	Yes	Yes	N/A
Import of National Geodetic Survey (NGS) data sheets in digital form?	No	No	No	Yes	Yes	Yes	Yes
PREPARATION OF PROCESSING NETWORK							
Presurvey planning?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Automatic arrangement of baselines?	Yes	Yes	No	Yes	Yes	Yes	No
Auto arrangement of independent baselines only?	Yes	Yes	No	No	No	Yes	Yes
User editing of occupation info after file loading?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Manual solutions?	Yes	Yes	No	Yes	Yes	Yes	Yes
Automatic Internet download of CORS data?	No	Yes	Yes	Yes	Yes	No	Yes
BASELINE PROCESSING							
GLONASS processing available?	Yes	No	No	Yes	Yes	No	Yes
Can precise ephemeris data, when available, be input?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Handle kinematic data or mixed with static?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Initialize kinematic on-the-fly?	Yes	Yes	No RTK	Yes	Yes	Yes	Yes
Provide multiple solution types (triple difference, widelane) Specify.	No	No	No	Yes	Yes	Yes	Yes
Results displayed in graphic form?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Statistical quality factors available?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Closure routines?	Yes	Yes	No	Yes	Yes	Yes	Yes
Ability to configure quality control indicators?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Will software process data from other manufacturers' receivers?	No	Yes	No	Yes	Yes, RINEX	Yes	Yes
COORDINATE TRANSFORMATION							
State Plane Coordinates?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
UTM Coordinates?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
User-definable datum and coordinate system?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Grid and ground coordinate system support?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
LEAST-SQUARES ADJUSTMENT							
Available with processing package?	Yes	Yes	No	Yes	Yes	Yes	Yes
If integrated, automatic geoid modeling?	Yes	Yes	N/A	Yes	Yes	Yes	Yes
Results displayed in graphic form?	Yes	Yes	N/A	Yes	Yes	Yes	Yes
Can adjust GPS, level and optical data together?	No	No	N/A	No	Yes	Yes	No
Able to define different weighting groups for different data types?	No	No	N/A	Yes	Yes	Yes	Yes
DATA EXPORT							
DXF output available?	No	Yes	Yes	Yes	Yes	Yes	N/A
Output RINEX files?	Yes	Yes	No	Yes	Yes	Yes	Yes
Formattable output files?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Export of National Geodetic Survey (NGS) Blue Book format report files?	Yes	Yes	No	Yes	No	Yes	Yes
Export of reports in html format?	Yes	Yes	CSV and TXT	Yes	Yes	Yes	Yes
Export to proprietary design, CAD, survey and GIS formats? (specify)		SHP, DXF, UDA	[28]	Yes	Yes [34]	Yes	Yes
GENERAL							
Integrated backup/restore?	No	Yes	No	Yes	Yes	Manual backup	Manual backup
Integrated feature code processing, linework generation and CAD editing?	No	Yes	[29]	No	Yes	Yes	N/A
Integrated contouring and DTM generation?	No	No	No	No	Yes	Yes	N/A
Display as observations, features or both?	Both	Yes	Features	Observations	Yes	Yes	Yes
Automatic calc of combined scale factor?	Yes	Yes	No	Yes	Yes	Yes	No
Hardware lock, key disk, or other copyright protection?	Hardware	[27]	No	Yes	Yes	Yes	Yes
Are all features above included as standard or are some sold as optional extras?	Yes	Option available	Standard	Standard	Yes	Yes	Standard
ADVANCED FEATURES							
U.S. SUGGESTED LIST PRICE (\$)	Call for current pricing	Call for best pricing	[30]	\$2,000 - \$8,000	\$2500 - \$3500	Contact Trimble dealer	Contact Trimble dealer
Are all software capabilities included in the price or are there additional upgrade modules?	Upgrades available	Upgrades available	Yes [31]	Yes	Yes	Contact Trimble dealer	Contact Trimble dealer
Are all software capabilities included in the price or are there additional upgrade modules?	Call for current pricing	Call for best pricing	[25]	Yes	Free online	Contact Trimble dealer	Contact Trimble dealer
Are update packages available to purchaser? If Yes, at what price? (U.S. \$)					[35]	[40]	[40]

2005 GPS Post-processing Software Survey

2005 GPS Survey Notes

Product Name	GPS Pathfinder Express	GPS Pathfinder Office	GrafNav/GrafNet	GrafNav Static
Manufacturer/Distributor	Trimble	Trimble	Waypoint Consulting Inc.	Waypoint Consulting Inc.
Manufacturer's phone number	720/887-4374	720/887-4374	403/720-3800	403/720-3800
Technical Support policy	[42]	[42]	[45]	[45]
Are Multi-License discounts available?	Subscription-based	Yes	Yes	Yes
Can individual modules be purchased separately?	Subscription-based	No	No	No
Are all features below supported in a single software package or are multiple packages required to achieve this? (# of packages required)	Single	Yes	Single	Single
OPERATING SYSTEMS				
Windows systems (specify)	Internet browser-based	[44]	[46]	[46]
Other (specify)			WINCE for datalogger	
DATA INPUT				
Proprietary GPS data formats read (specify)	SSF	SSF	[47]	[47]
Handle RINEX files?	Yes, base only	Yes (base only)	Yes	Yes
Edit capability (antenna info, station names, etc.)	No	Yes	Yes	Yes
Maximum number of input files	N/A	None	None	None
Maximum number of points or occupations	N/A	None	None	None
Proprietary Optical Total Station and level raw observation formats read (specify)	N/A	N/A	No	No
Import and display of background DXF maps and aerial orthophotos?	N/A	Yes	Yes, DEM only	No
Import of National Geodetic Survey (NGS) data sheets in digital form?	N/A	No	No	No
PREPARATION OF PROCESSING NETWORK				
Presurvey planning?	N/A	Yes	Yes	Yes
Automatic arrangement of baselines?	N/A	N/A	Yes	Yes
Auto arrangement of independent baselines only?	N/A	N/A	Yes	Yes
User editing of occupation info after file loading?	N/A	Yes	Yes	Yes
Manual solutions?	N/A	N/A	Yes	Yes
Automatic Internet download of CORS data?	Yes	Yes	Yes	Yes
BASELINE PROCESSING				
GLONASS processing available?	No	No	Yes	Yes
Can precise ephemeris data, when available, be input?	No	No	Yes	Yes
Handle kinematic data or mixed with static?	No	Kinematic, but not RTK	Yes [48]	No
Initialize kinematic on-the-fly?	N/A	N/A	Yes	No
Provide multiple solution types (triple difference, widelane) Specify.	Code phase only	Fixed, float, code	[49]	[49]
Results displayed in graphic form?	No	No	Yes	Yes
Statistical quality factors available?	Yes	Yes	Yes, many	Yes
Closure routines?	No	No	Yes	Yes
Ability to configure quality control indicators?	No	Yes	Yes	Yes
Will software process data from other manufacturers' receivers?	Yes, base files only	Yes, base files only	Yes	Yes
COORDINATE TRANSFORMATION				
State Plane Coordinates?	No	Yes	Yes	Yes
UTM Coordinates?	No	Yes	Yes	Yes
User-definable datum and coordinate system?	No	Yes	Yes	Yes
Grid and ground coordinate system support?	No	Yes	[50]	[52]
LEAST-SQUARES ADJUSTMENT				
Available with processing package?	No	No	Yes	Yes
If integrated, automatic geoid modeling?	No	No	Yes	Yes
Results displayed in graphic form?	No	No	Yes	Yes
Can adjust GPS, level and optical data together?	No	No	No	No
Able to define different weighting groups for different data types?	No	No	N/A	N/A
DATA EXPORT				
DXF output available?	Yes	Yes	Yes	Yes
Output RINEX files?	No	No	Yes	Yes
Formattable output files?	No	Yes	Yes	Yes
Export of National Geodetic Survey (NGS) Blue Book format report files?	No	No	Yes	Yes
Export of reports in html format?	No	No	No	No
Export to proprietary design, CAD, survey and GIS formats? (specify)	[43]	[43]	No	No
GENERAL				
Integrated backup/restore?	N/A	No	No	No
Integrated feature code processing, linework generation and CAD editing?	N/A	Yes	No	No
Integrated contouring and DTM generation?	N/A	No	No	No
Display as observations, features or both?	N/A	Both	Yes	Both
Automatic calc of combined scale factor?	N/A	No	Yes	Yes
Hardware lock, key disk, or other copyright protection?	Subscription-based	Activation code	Yes	Yes
Are all features above included as standard or are some sold as optional extras?	Standard	Standard	No	[53]
ADVANCED FEATURES				
U.S. SUGGESTED LIST PRICE (\$)	\$34.95 per month	Contact dealer	\$5,500	\$3,000
Are all software capabilities included in the price or are there additional upgrade modules?	Free	Contact dealer	N/A	[54]
Are update packages available to purchaser? If Yes, at what price? (U.S. \$)			[51]	

GEODETIC RECEIVERS

- Geoid/Grid/Ground/Local.
- 8 each parallel channels of L1 code, L1 carrier, L2 code, L2 carrier.
- The Receiver handheld is both the dual-frequency receiver and data collector. However, other data collectors can be interfaced to the Rascal.
- 100% waterproof.
- Rascal Antenna has been tested and characterized by NGS.
- For > 30 ft., consult factory.
- Helical Antenna design yields superior gain compared to typical patch antenna elements.
- L1 Phase, L1 C/A, L2 Phase, L2 P-Code. Fully independent L1 and L2 code and phase measurements.
- Compact Flash Card/USB or serial download.
- SmartTrack patented discrete elliptical filters. Fast acquisition. Strong signal. Low noise. Excellent tracking, even to low satellites and in adverse conditions. Interference resistant. Multipath mitigation.
- Via user-selected PC/PDA & S/W.
- L1 Phase, P1, L2 Phase, P2, C/A, C/No, WAAS.
- StarFire 1PPS (optional).
- User selectable; overall weight and power consumption will vary.
- RTK, 50 Hz data options. NavCom StarFire corrections received through the integral tri-band antenna provide real-time decimeter positioning accuracy without the requirement for a separate base station and with near global coverage. Requires service subscription.
- Optional extras include CAN bus interface, 1PPS output and Event in ports.
- Depends on cable type and connector. Total signal loss must not exceed 10 dB at 1.5 GHz.
- Via NavCom S/W on PC.
- L1/L2 and L2/Code and Carrier.
- Semi-independent L1 and L2 code and phase measurements.
- WAAS/EGNOS, OmniStar VBS/HP.
- 12 + Omnistar + CDGPS.
- Via optional data collector.
- External or Int. OmniStar HP.
- Built-in CDGPS and OmniStar VBS & HP capable.
- 3.3 ft standalone/7.2 ft pole.
- Via Internet-based software.
- 80 GB typical, expandable.
- External radio, internal internet-based corrections.
- Multiple internet-based RTK users.
- GPS card and carrier board 1.95W (typical).
- GSR2700 RS can be used as a permanent base station with multiple data storage and RTK sessions running simultaneously. It can be used for static and RTK applications. Interface to user is via the GSR Reference Station Software through an internet connection. The GSR2700 RS is a rack mountable reference station which includes a dual-frequency GPS receiver, an Intel/WinXP based PC with 80 GB hard drive and comes pre-installed with the GSR Reference Station Software.
- L1/L2 Code and Carrier.
- Up to 96 sessions can be programmed. MicroManager Pro software available for automatic download by modem. Full integration with Met and Tile sensors.
- TCP/IP connectivity. Automatic FTP of collected data. Streams data through Internet.
- L1 C/A, L1 Carrier, P-code, L2 Carrier.
- Removable memory, USB, Bluetooth, serial.
- Patent pending ADAPT-RTK technology. Patent pending Vortex UHF antenna technology. Internal UHF + cellular.
- KART: real-time kinematic processing with OTF init. for L1-only receiver, up to 12 km. LRK: Long Range Kinematic processing technology for fast, reliable, real-time centimeter-level positioning up to 40 km.
- 2 internal radio receivers, e.g. UHF and HF/MF.
- 16 (Sagitta01), 28 (Sagitta02).
- With data collector.
- Using attached data collector.
- H: 0.3 cm + 0.5 ppm x D // V: 0.5 + 0.5 ppm x D.
- H: 0.3 cm + 1 ppm x D // V: 0.5 cm + 1.5 ppm x D.
- H: 1 cm + 1 ppm x D // V: 1.5 cm + 1 ppm x D.
- 1 cm + 1.5ppm x D // V: 1.5cm + 1.5ppm x D.
- L1-C1-P1-D1-L2-P2-D2GPS/GLONASS.
- With external beacon receiver.
- With external DGPS receiver.
- Hiper XT has an internal GSM modem for receiving corrections from cellular enable bases or networks. The unit also has an internal UHF radio to communicate with traditional radio enabled base stations. The Hiper XT also uses Bluetooth as the mode of communication to the field controller or desktop PC.

2005 GPS Survey Notes

52. The Legacy Plus utilizes the new 112G Turbo board inside. This allows for much more room for advanced firmware options and flexibility for future upgrades.
53. Without line amplifier.
54. Receiver options and upgrades performed via software activation codes.
55. Totally integrated, cable-free RTK base and rover system. Bluetooth technology for controller communications. Internal UHF radio for transmit and receive of RTK corrections. Upgradeable via Internet or E-mail. Advanced options include Co-Op tracking, Advance Multipath Reduction.
56. Receivers upgradeable via Internet or E-mail. Advance optional features include: Co-Op tracking, Advance Multipath Reduction, Bluetooth Technology. Completely wireless receiver.
57. Center-mounted RF antenna technology.
58. Center-mounted SpSp antenna technology.
59. PG-A1/PG-A2/Legant/Legant-3 (zero centered).
60. Receivers upgradeable via Internet or E-mail. Advance optional features include: Co-Op tracking, Advance Multipath Reduction, In-Band Interference Rejection.
61. CF card slot, and external PC.
62. Receivers upgradeable via Internet or E-mail. Advance optional features include: Co-Op tracking, Advance Multipath Reduction. Onboard display.
63. Receivers upgradeable via Internet or E-mail. Advance optional features include: Co-Op tracking, Advance Multipath Reduction. Internal camcorder batteries.
64. L1 C/A code L1 full cycle carrier, fully operational during encryption
65. Measurements rates user configurable; 1 Hz, 2 sec, 5 sec, 10 sec, 15 sec, 30 sec, 60 sec, 5 min, 10 min.
66. Available with attached data collector.
67. Grid, Local and Ground coordinates available with attached data collector
68. Direct to PC or data collector.
69. Data transfer to/from the receiver: Serial Ports (2xRS232)
70. Using 1MB CF card >64 hours @ 5SVs storing at 15 sec intervals L1/L2.
71. Receiver dimension: 11.8 cm H x 22.1 cm W (4.64" H x 8.7" W).
72. Receiver only PP (with batteries) 1.70kgs (3.7lbs).
73. 100% condensing, unit fully sealed.
74. Tested to survive a 2 m (6.7 ft) drop onto concrete.
75. >32 hrs with C-cell batteries.
76. For the many advanced features, refer to the Trimble website at www.trimble.com.
77. WAAS/EGNOS.
78. Measurements rates user configurable; 10 Hz, 5 Hz, 2 Hz, 1 Hz, 2 sec, 5 sec, 10 sec, 15 sec, 20 sec, 60 sec.
79. In RINEX notation GPS L1, C1, P1, D1, L2, P2, D2* *Doppler on L2 can be constructed from the raw data.
80. Data transfer to/from the receiver with Compact Flashcard in place: serial ports (3xRS232), USB port, removable Compact Flashcard.
81. Limited only by Compact Flashcard technology. Using 64MB CF card >1700hours @ 6SVs storing at 15 sec intervals L1/L2, Using 128 MB CF card >3400 hours @ 6SVs storing at 15 sec intervals L1/L2.
82. Receiver dimension : 8.5 cm H x 13.5 cm W x 24 cm D (3.4 in H x 5.3 in W x 9.5 in D).
83. Receiver only PP (with batteries) 1.2 kg (2.7 lbs) / Receiver only (with internal radio, batteries, UHF antenna included) 1.40 kg (3.0 lbs).
84. Zephyr Geodetic 1.31 kg (2.88 lbs), Zephyr 0.55 kg (1.20 lbs), Choke Ring 4.55 kg (10 lbs).
85. Total 4 kg (8.8 lbs) as full RTK rover with 2 batteries, including internal battery charger and radio modem.
86. Shock MIL-STD-810 F to survive a 1 m (3.3 ft) drop onto concrete.
87. >5.5 hrs using single battery.
88. In-line amplifier required for cable lengths greater than 30 m (100 ft)
89. Using 2 MB internal memory >55 hours @ 6SVs storing at 15 sec intervals L1/L2.
90. Receiver dimension: 10 cm H x 19 cm W (3.9 in H x 7.5 in W)
91. Receiver only PP (with battery) 1.21 kg (2.7 lbs) / Receiver only (with internal radio, batteries, UHF antenna included) 1.21 kg (2.7 lbs).
92. Total 3.57 kg (7.87 lbs) as full RTK rover with battery, radio modem, range pole and data collector.
93. L1 C/A code, L2C Code, L1/L2 full cycle carrier, fully operational during encryption, WAAS/EGNOS.
94. Using 6 MB internal memory >330 hours @ 6SVs storing at 15 sec intervals L1/L2.
95. Able to be configured and controlled anywhere with Internet connection.
96. Data transfer to/from the receiver: Serial Ports (4xRS232), LAN Port (10BaseT/100BaseT).
97. Unlimited using Internet. Using internal 150 MB > 3400 hours @ 7SVs storing at 15 sec intervals L1/L2.
98. Designed as geodetic reference station. RTK and DGPS support using Trimble GPS base or Trimble GPSNet software.
99. Receiver dimension : 6.5 cm H x 22.8 cm W x 14 cm D (2.6 in H x 9 in W x 5.5 in D).
100. Receiver only 1.6 kg (3.5 lbs).
101. <3.0 Watts for NetRS, 3.5 Watts with Dorne & Margolin choke ring

antenna and 4.0 Watts with a Zephyr Geodetic antenna.

MAPPING/POSITIONING RECEIVERS

1. GS20 Professional Data Mapper combines the power of a professional GPS system collecting GIS data, with the convenience of a handheld system. Onboard GIS data collection interface. Bluetooth wireless communication. Wireless Real-time Correction System accessories (the WoRCS). Real-time coordinate quality indicator. MaxTrak & Hypertrak for Robust GPS reception. GIS DataPRO software. GPS post-processing software.
2. GS5+/GS5 is an all-in-one GPS receiver, antenna and beacon receiver unit. NMEA output. Available bundled as a backpack system with the Panasonic Toughbook01 data collector and ESRI's ArcPad software.
3. Options for RTCM correction input.
4. Via user-selected PC/PDA & S/W.
5. User-selectable; overall weight and power consumption will vary.
6. NavCom StarFire corrections received through the integral tri-band antenna provide real time decimeter positioning accuracy without the requirement for a separate base station and with near global coverage. Requires service subscription.
7. Optional extras include CAN bus interface, 1PPS output and Event in ports.
8. Via optional data collector.
9. SD card or Nand Flash.
10. Using MobileMapper Beacon.
11. PC/ABS with rubber overmold.
12. Optional external patch antenna.
13. MobileMapper CE integrates submeter positioning with embedded Windows CE .NET, Bluetooth wireless technology and many more valuable features to offer field professionals the ultimate combination of high-performance and affordability. Designed for extreme outdoor and industrial environments. Field replaceable all-day battery.
14. Grid mapping utility. Handheld DGPS/GIS data logging system; ruggedized; submersible; submeter accuracy in post-processing; full GIS attribution; Office software for GIS support.
15. KART (single frequency) OTF kinematic processing; LRK Jewel frequent OTF kinematic processing; REFSTATION processing of corrections in DGPS/KART/LRK mode; relative OTF determination of non-fixed relative baseline between two mobiles; built-in display (multiple UHF/HF/MF options).
16. L1 with 16 parallel channels, 12 are GPS, 4 are WAAS.
17. Single cable to connect Jewel antenna. Heading reference 0.5 degrees.
18. Dual-frequency GPS/GLONASS.
19. GPS+GLONASS.
20. External PC or controller.
21. Combined L1/L2 OmniSTAR HP.
22. Integrated Bluetooth wireless communications and Omnistar HP capable. Upgradeable via E-mail and internet w/activation codes. Receiver can be used as precise GIS receiver or as survey grade dual frequency rover.
23. Integrated electronic compass.
24. The GMS-2 integrates the latest in high technology in a handheld mapping product. Inside the GMS-2 is an electronic compass and a digital camera.
25. Option to record on field controller.
26. L1 GPS/GLONASS-Omnistar-Beacon-WAAS.
27. The new GMS 110 system features a Bluetooth enabled field computer that communicates wirelessly with the backpack system.
28. Using Beacon on a Belt (BoB).
29. Additional Bluetooth ports available.
30. Optional hurricane or patch antenna.
31. Depends on datalogger.
32. Combined L1/Satellite DGPS.
33. Combined L1/Beacon/Satellite DGF.
34. Combined L1/Beacon.
35. OmniStar HP 10 cm CEP.

GPS POST-PROCESSING SOFTWARE

1. 1 year free support and upgrade.
2. WIN 9X, NT, XP, ME, 2000.
3. L1, L1L2, L3-Iono Free.
4. Nearly all GPS manufacturer's formats supported.
5. Yes, except kinematic processing.
6. Leica Advantage Support: Bronze (free), Silver, Gold Level Support (contact Leica for pricing and details).
7. Windows 95, 98, NT, 2000, XP.
8. Microstation, Autocad, MapInfo.
9. The continuous ambiguity checking of CheckMate technology on board the System 500 sensor is duplicated in the post processing software. Immediately after having completed the ambiguity search routine and having computed the most likely ambiguities with one set of GPS observations, SKI Pro repeats the whole ambiguity search routine using a different set of GPS observations. This results in a second set of ambiguities. The ambiguities computed in this second search routine are then compared with the ambiguities computed in the first ambiguity search. If the two sets of ambiguities are identical, then the ambiguities are considered to be correct. In order to ensure the highest possible reliability the ambiguity search routine is continually repeated for the entire observation interval.

10. Free basic level support.
11. L1, L2, L1+L2, Iono Free (L3).
12. Easy, fast and comprehensive, automated suite of programs for TPS, GPS and level data. View and manage TPS, GPS and level data in an integrated way. Process independently or combine data, including post processing and support of real-time GPS measurements. Manages all data in an integrated manner. Project management, data transfer, import/export, processing, viewing data, editing data, adjustment, coordinate systems, transformations, codelists, reporting etc. Consistent operating concepts for handling GPS, TPS and level data, based on Windows standards.
13. Win2000/XP professional.
14. RINEX, LB2, OWI, MDB, CMR.
15. Via scripting to Ski Pro.
16. Spider is a PC service-based operation: a new, advanced, affordable Internet/ dial-up GPS reference station software program with full Internet connectivity for controlling, operating, and managing reference stations. It controls, configures, downloads automatically with warning messages, monitors systems, distributes data, configures RTK (RTCM, CMR, Leica). Advance GPS product generation (RINEX, Compressed, Zipped, FTP). 24/7 fully automated.
17. Windows 9x/NT/2000/ME/XP.
18. SOKKIA, Ashtech, Trimble.
19. Free phone/E-mail support.
20. All static and RTK vector imports are built-in.
21. G-Files and Geoid Files.
22. STAR*NET-PRO is a standalone Least Squares Network Adjustment Package that handles GPS vectors, conventional and leveling. Additional editions STAR*NET and STAR*NET-PLUS (\$795 and \$995) handle conventional observations and differential leveling but without GPS support.
23. Individual utilities for converting data collector formats (TDS, Carlson, SDR, SMI, Geodimeter, Trimble TSCe, etc.) and digital level formats (Leica, Zeiss/Trimble, Topcon, etc.) are available as separate modules \$145 to \$195.
24. \$695 upgrade from previous STAR*NET-GPS V5 DOS-based package.
25. Free with product registration.
26. Thales Navigation/Ashtech.
27. HW and SW protection available.
28. SHP, MIF, DXF, CSV.
29. Feature code processing.
30. \$1795 hardware+software - MobileMapper System.
31. Including post processing.
32. 95/98/Me/NT/2000/XP.
33. Optical total stations, digital level.
34. SHAPE, DXF, ASCII.
35. RTK module allows analysis and adjustment of data based on observation variances & co-variances, with point precision information available for RTK measurements. Topcon Tools provides seamless integration between total station, GPS, GIS, digital level, and RTK data through a suite of standalone software modules for each.
36. Single package available.
37. Microsoft Windows 98, XP, ME, NT, 2000.
38. Supports Trimble field formats: DAT, DC, T00, T01, GPSurvey database, TDS formats.
39. Supports Trimble, TDS, Nikon, SDMS, Topcon, Leica, Sokkia, Autodesk file formats.
40. For the many advanced features, refer to the Trimble Geomatics website at www.trimble.com.
41. Supports Trimble field formats: DAT, DC, T00, T01, GPSurvey database.
42. Free web support. E-mail/phone support through reseller. Paid Priority Support available in U.S.
43. ArcView Shapefile, MapInfo MIF, Microsoft Access MDB, dBASE.
44. Windows 95/98/Me/NT/2000/XP/XP Tablet PC edition.
45. 1 year free support and upgrades after purchase.
46. Windows 95/98/ME/NT/2000/XP.
47. AOA (all models, AOA version only), Ashtech (b-file, DSNP and real-time), Connexant (Jupiter/NAVCOR), CSI DGPS-MAX, Javad/Topcon (all models), Leica (SR, MX, System 500), Motorola, Navcom (all models), NovAtel (OEM4, OEM3, OEM2 and CMC), RINEX, Septentrio, Sif Binary, Trimble (DAT, Real-time, TIPY, TSIP, GRAM), U-BLOX.
48. Kinematic or mixed.
49. L1, L1L2, L3-IonoFree.
50. TM, Lamber, Oblique and Local Grid.
51. Windows and WinCE datalogger, advanced kinematic processing, automatic detection of receiver format, and multiple base station batch processor.
52. Transverse Mercator and Lambert Conformal.
53. Kinematic extra.
54. Yes, except kinematic processing.

POB does not assume responsibility for any errors or omissions that may be contained within the survey.