

TRIMBLE CONTROLLERS: TECHNOLOGY AND CHOICE FOR THE INTEGRATED SURVEYING SOLUTION

GLENN MARTIN, TRIMBLE NAVIGATION LTD
WESTMINSTER, COLORADO, U.S.A.

ABSTRACT

The unique Integrated Surveying™ solution from Trimble delivers a synergy of efficiency and productivity via one specialized data collector (controller) and one field software application. The system combines measurements from a variety of sensors—including optical and GPS—into a single job file ready for immediate viewing, processing, and transferring.

While the importance of the field software in this equation is not to be understated, fundamental to the success of the system are the ruggedness, power, versatility, and usability of the hardware component. To this end, Trimble has designed and manufactured a family of Trimble controllers diverse enough to meet the needs of surveying and engineering applications worldwide, but all sharing the qualities described. The Trimble controllers discussed here are the Trimble® CU, the Trimble® TSC2™, and the Trimble® Recon™.

ESTABLISHING METRICS FOR ASSESSING QUALITY

FIELD SUITABILITY

Whichever descriptor is ultimately used—field computer, data collector, or controller—the hardware component is a computer designed for use on the survey job site. The controller is thus exposed to environmental conditions such as extreme heat or cold, water, mud and dust, not to mention various knocks and drops over time.

For this reason, it is essential that the controller, as the housing for advanced field software, be as rugged and durable as possible. In addition, the controller itself comprises numerous electronic components, all of which must be integrated in such a way that the controller remains robust in the field.

Trimble Engineering and Construction Group, 5475 Kellenburger Road, Dayton, OH 45424-1099, USA

© 2005, Trimble Navigation Limited. All rights reserved. Trimble, and the Globe & Triangle logo are trademarks of Trimble Navigation Limited registered in the United States Patent and Trademark Office and other countries. Integrated Surveying, Trimble Survey Controller, and TSC2 are trademarks of Trimble Navigation Limited. Recon and Survey Pro are trademarks of Tripod Data Systems Inc., a wholly owned subsidiary of Trimble Navigation Limited. The Bluetooth word mark and logos are owned by the Bluetooth SIG, Inc. and any use of such marks by Trimble Navigation Limited is used under license. Microsoft, Windows, and Windows Mobile are either registered trademarks or trademarks of Microsoft Corporation in the United States and/or other countries. All other trademarks are the property of their respective owners. 022543-142 (07/05).

When measuring controller quality, it is necessary to assess the following hardware metrics, which must be certified or meet international safety standards:

- Resistance to vibration and shock
- Operating temperature range
- Resistance to particles and water
- Electrical conductivity, spurious radio wave and electronic emissions
- Platform size and operating ergonomics

Within these metrics, Trimble controllers provide a consistently high level of acceptance or range of use. During product development, Trimble performs rigorous laboratory and real-world field tests in as many environmental conditions as possible. Then once the controller is in production, Trimble continuously monitors the quality of shipped units to maintain the highest standards and ensure the product will withstand typical field use and abuse. However, hardware metrics alone do not provide sufficient guidance on controller quality. The potential productivity and efficiency gains offered to surveyors via their choice of controller are best measured separately.

HARDWARE EFFICIENCY

For surveyors, accurate and efficient data collection is the key to success. Although field software drives workflow, the technologies in controller hardware are critical in determining the level of productivity gained.

Hardware efficiencies can be measured as follows:

Feature	Benefit
User interface screen	Size, display graphics, ability to easily view in low light or bright sunshine, touch screen data entry capabilities
Keyboard	Ease of use, hot keys, and tactile response. Operation in extreme temperatures
Communication ports	Connection for data transfer or communication to sensors and devices
Wireless technologies	Cable-free and wireless connection for data transfer or communication to sensors and devices
Memory storage and program memory	Size, speed and organization of application or data files
Processing power	Speed and performance for computations
Power consumption	Long battery life (operational or non-operational)
Operating system	Proprietary or non-proprietary open solutions to allow plug and play software to control sensors and devices
Software flexibility	Market application solutions to suit your needs

TRIMBLE CU CONTROLLER



Designed to support the Trimble® S6 Total Station, the Trimble® CU controller offers much more than simple total station control. Detaching completely from the Trimble S6 instrument, the flexible Trimble CU enables surveyors to utilize their database in multiple ways in and around the field and office with both total stations and GPS receivers.

User Interface Screen

The user interface screen of the Trimble CU is a ¼ VGA 3.8" color touch screen, which provides the following significant advantages:

- The color screen shows more depth, clarity, and detail than a monochrome screen, which is ideal for operation in bright sunlight.
- Data entry and configuration is quick and easy via the touch screen.

The Trimble CU also provides a backlight for the screen and keyboard solution, so that operation in poor lighting is easier.

Its user interface features alone make the Trimble CU easier, more ergonomic, and more enjoyable for surveyors to use in the field. As a result, the possibility

of errors caused by tiredness and strain reduces, while job satisfaction, efficiency, and productivity increase.

Keyboard

For efficiency, the Trimble CU offers an alphanumeric keyboard plus smart function keys that enable fast access to frequently-used commands in the Microsoft® Windows® operating system and Trimble software.

The Trimble CU keyboard allows users to take advantage of the full potential of the controller. The design and placement of the keys makes keyboard operation fast and efficient. In particular, the functions and location of the multi-direction arrow key and multi-use Enter key provide significant benefits for operating external sensors. When these keys are used with the touch screen and stylus, users can more quickly edit, add, and manage their data.

Communication Ports

The absence of physical ports on the Trimble CU is due to the sophisticated design of the controller, which uses a hot-shoe to connect to the Trimble S6 instrument and robotic holder, as well as a GPS holder for use with Trimble GPS systems.

These holders use USB communication protocols to provide fast, safe, and efficient communications and data transfer. The holders also provide power to the Trimble CU via a 4400 mAh lithium ion battery.

Wireless Technologies

The Trimble CU incorporates several wireless technologies for cable-free field convenience:

- Integrated Bluetooth technology provides cable-free communication to Trimble R8 and 5800 GPS systems or other Bluetooth devices.
- In the robotic and GPS rover holders, external ancillary devices, such as USB sticks or CompactFlash card drives can be used. These external memory media enable efficient data transfer from the Trimble CU to other devices in the field and office.

Storage Memory and Program Memory

The Trimble CU memory comprises two types: storage memory and program memory.

Storage memory is the non-volatile memory in which users can safely store data, images, documents, and files. Storage memory was once shared with program memory, a fact that hindered product optimization. However, these days program space resides in a non-volatile media, so the two types of memory are separated.

The Trimble CU contains a wealth of space for both program (64 MB SDRAM) and storage (256 MB Internal Flash) memory. This large capacity means that workflow is uninterrupted by users having to manage data storage, and it allows the Trimble CU, especially when used with USB storage devices, to support very large files.

Processing Power

Processing power is necessary to compute digital data and update, share and run programs.

The microtechnology of computer processing in personal computers is now being applied in field computers. For instance, the Trimble CU uses an XScale processor manufactured by the Intel Corporation. This 400 Hz processor computes thousands of user-defined commands with great ease while consuming only the tiniest amount of energy.

Power Consumption

The electrical engineering design must not only be small and lightweight but must provide sufficient energy to power continuous operations in very cold or hot temperatures. For this reason, the Trimble CU uses lithium-ion technology, which means a single battery can power continuous operation for up to 12 hours at typical room temperatures of +20°C.

Operating System

Power consumption thriftiness is designed in the electrical definition, but it is also achieved in association with the operating system.

Microsoft Windows operating systems are becoming a universal standard for field and office data collection industries, including surveying and engineering. The Microsoft CE.NET solution benefits users by enabling the use of commonly used applications such as the Internet and messaging solutions. This is especially beneficial when users are remote from the office, as it

allows them to connect to the office via a cellular device. This bridges the communication gap between the office and field work; almost real-time changes can be provided to quickly satisfy the needs of clients.

Using the familiar architecture and workflows of the Microsoft operating system also benefits surveyors who have used other Microsoft Windows devices. Users' learning curves are reduced so productivity is preserved.

One of the other many benefits of the Microsoft operating system is in the flexibility in design of Field Application software. Trimble already provides several global and regional software application software designs to the various needs of construction, surveying and engineering needs.

The Trimble CU provides all the superior functions surveyors need in a controller. However, the Trimble CU is designed to work with the Trimble S6 and Trimble GPS systems. Surveyors may require a controller with more sensor independence, and thus may look to the TSC2 controller to meet those needs.

TRIMBLE TSC2 CONTROLLER

The Trimble® TSC2™ controller takes cutting edge technologies and provides them to surveyors today. The TSC2, with its ergonomic, handheld form factor, is the next generation of Trimble's popular TSC1 and TSCe controllers. The controller is designed to fit comfortably in the palm of the hand, or to be mounted on a range pole or tripod.



User Interface Screen

Like the Trimble CU, the TSC2 also has a ¼ VGA 3.8" color touch screen. This large, easy-to-read screen provides the same efficiencies as the Trimble CU. A backlight also provides the complete solution for all conditions.

Keyboard

The TSC2 keyboard complements the touchscreen, and its design allows users to take advantage of the full potential of the controller:

- Large oversized keys with positive tactile response are easy use even when wearing protective gloves.
- For efficiency, the TSC2 offers an alphanumeric keyboard plus smart function keys that enable fast access to frequently used commands in the

Microsoft Windows operating system and Trimble software.

- The design and placement of the keys makes keyboard operation fast and efficient. In particular, the functions and location of the multi-direction spider key and multi-use Enter key provide significant benefits for operating external sensors. When these keys are used with the touch screen and stylus, users can more quickly edit, add, and manage their data.

Communication Ports

Interfacing with a range of devices and sensors requires communication port flexibility, which the TSC2 has in abundance via the following:

- Dual Compact Flash card
- Secure digital media
- USB
- Serial RS 232

Field computers have never been so “communicative”.

Wireless Technology

Integrated wireless technologies allow the TSC2 to be completely cable free. The TSC2 has “interoperability”, that is, it can connect to many devices with or without the need for physical connection.

The TSC2 offers Bluetooth technology and 802.11b network support, which allow seamless field and office communication. The immediate benefits are:

- Dramatically increased productivity

- Less wear and tear, that is, on cables and connections

And gone are the days of being left stranded when a cable was forgotten or broken preventing the work to be completed.

Storage Memory and Program Memory

The TSC2 has capacious non-volatile memory storage of 512 MB NAND Flash supported by 128 MB SDRAM of program memory. The TSC2 supports both CompactFlash and SD removable memory media types in addition to the large internal memory of the device. The flexibility of these many memory capabilities facilitate fast and easy transfer of large data files.

Processing Power

As the latest release in Trimble’s family of controllers, the TSC2 has the greatest processing power yet. The TSC2 uses a next-generation Intel XScale 520 MHz processor, and thus offers impressive computation speed and performance.

Power Consumption

Despite its significant processing power, the TSC2 does not require a large and cumbersome power pack. The controller’s electrical components were designed with energy efficiency in mind, and therefore provide excellent battery performance in all conditions. Running out of power during the field operation is one less concern for the field operator; and users can monitor power levels via the operating system or by the LED power indicator in the battery module.

The Trimble TSC2 features a removable PowerBoot module, which combines the battery and port communications into a single unit that can be changed by the user. This system provides flexibility in combining port communications and power, making it a truly intelligent battery. The design of the PowerBoot module will enable future battery and communication technologies to be quickly adapted to the TSC2. In addition, the battery can be recharged separately from the main TSC2 module.

Operating System

To manage all these features, the TSC2 runs the Microsoft Windows Mobile™ for Pocket PC operating system, which can only be offered when a product developer, in this case Trimble, meets the stringent hardware requirements of Microsoft.

The Pocket PC operating system offers enormous benefits to users. Pocket Word, Pocket Excel, and Pocket Messaging (Outlook) come standard with the operating system, so users can easily perform office functions in the field. Pocket Internet Explorer makes Internet access possible for uploading and downloading data, files, and plans while in the field. Specialized surveying software can then be installed to provide extensive field application solutions to best suit your needs; the TSC2 runs Trimble Survey Controller™ or a regional solution such as TDS Survey Pro™ with TSX (Trimble® Systems Extension) field software.

TRIMBLE RECON



The rugged Trimble® Recon™ controller has been especially built for users who require extensive data collection controls that can be managed quickly and efficiently via a touch screen panel.

User Interface Screen

The Trimble Recon user interface screen practically drives the entire device.

The Trimble Recon provides a ¼ VGA 3.8" portrait screen. The portrait orientation suits longer forms, which is especially useful for users who require a different and larger organization of data entry.

The Trimble Recon is built with simplicity of operation in mind. The product includes a minimum of keys to support the Microsoft Windows Mobile for Pocket PC framework requirements. Essentially, the keyboard interface is truly the touch screen. To assist with fast and efficient data entry on screen, several methods of data entry are included, such as the Transcriber and pop-up alphanumeric keyboards.

Communication Ports

Much like the TSC2, the Trimble Recon controller's communication ports are designed to suit the needs of sensor independent devices. The Trimble Recon supports both USB guest and Serial RS 232 ports. Cable-free wireless technologies are available, included by the insertion of CompactFlash card media in the dual CompactFlash card slots provided. The battery and communications ports are contained in the removable PowerBoot module. The Trimble Recon controller's communication capabilities provide flexibility in connection to external sensors and to office PCs for data transfer.

Storage Memory and Program Memory

Like its other family members the Trimble Recon provides large internal non-volatile storage memory (128 MB Internal Flash) and is also supported by program memory size of 64 MB of SDRAM. Memory worries are now firmly a thing of the past.

Processing Power

The Trimble Recon uses an Intel XScale processor provided in both a 200 MHz model and a 400 MHz model. This provides for a range of solutions that both meet the user's needs and price point.

The power consumption of the Trimble Recon is small and this thriftiness equates to long continuous use. Recharge times of less than 2 hours mean that downtime is insignificant. It is even possible to power the device using off-the-shelf AA batteries and a battery adapter pack.

Operating System

The Trimble Recon also meets the stringent requirements for running the Microsoft Windows Mobile for Pocket PC operating system. Like the TSC2, this provides many benefits by using a standardized software application. It also provides users the opportunity to install third-party software applications to assist them with their daily needs. And it also runs Trimble field software solutions on top of the standard Pocket PC applications.

CONCLUSION

Long gone are the days of difficult-to-use, power-hungry controllers with drab monochrome user interfaces and memory that could be filled to capacity by your first few hours work. An entire suite of advanced Trimble controllers is now available from which surveyors and engineers can choose a solution that best suits their individual business needs.

As well as being a key component in Trimble's Integrated Surveying solution, Trimble controllers embrace the core principles of flexibility, future proofing, environmentally toughness for any job conditions, thereby bringing to users increased efficiency and productivity.

Further in-depth product specification analysis of each of the Trimble controllers mentioned in this paper is provided on the Trimble website www.trimble.com. Alternatively contact your nearest Trimble distribution partner.