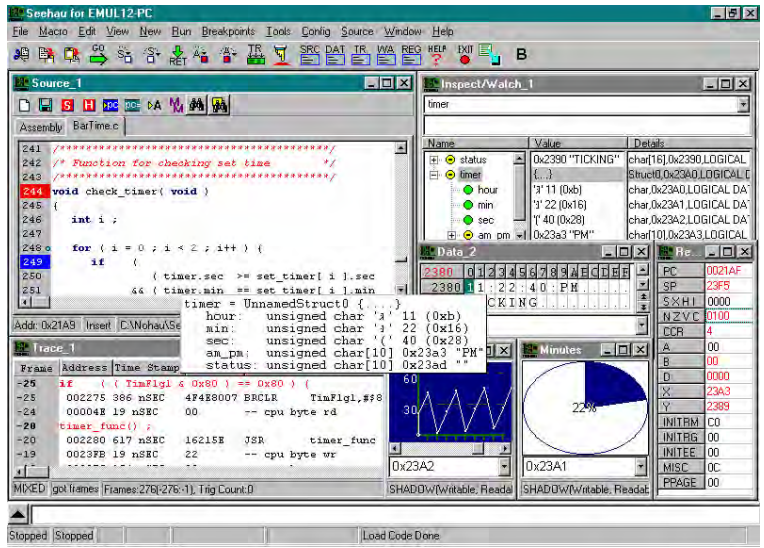
Overview of the Nohau S12X Emulator

Included in this Presentation

1. Overview of the Nohau S12X Full-Emulator and BDM support
2. Nohau's Emulator support for all HCS12 A, B, C, D, E, H, K & T families
3. Key HCS12 (and S12X) features that are available only in the Nohau emulator
4. Nohau's deep involvement in the S12X silicon-design stages
5. Seehau S12X screen-shots and features

NOHAU CORPORATION

S12X Family In-Circuit Emulator



- Includes all the debug features of the Nohau HCS12 Emulator
- 40MHz - maximum speed operation
- User-configurable 5V/3.3V operation
- BDM support also available
- Advanced emulator debug features:
  - Unlimited Number of Breakpoints
  - Option for a sophisticated Hardware-Trace of 1,000,000 frames, Triggers and a Filter system, Code Coverage and Code Profiling
  - Internal Trace support
  - Extensive Dual Processor – XGATE and S12X CPU debug support
  - Easier debugging using Emulation RAM and Shadow RAM
  - S12X fast STOP wake-up & Self-Clock (not possible with BDMs)
- Find more information at: www.icetech.com/s12x

NOHAU Corporation ▪ Email: sales@icetech.com ▪ Tel: 650.375.0409

Nohau's S12X Emulator and BDM

- Nohau offers Full-Emulator and BDM support for the Motorola/Freescale S12X family
- New full-emulator components (emulator & trace) are used for the S12X - due to the changes in the external S12X bus interface, and the increase in speed from HCS12 25MHz to the S12X 40MHz
- BDM is offered at two support levels and price points:
  - With S12X internal silicon trace support
  - Without S12X internal silicon trace support

External Trace vs. Internal Trace

The External Trace and Internal Trace compliment each other, and are both necessary to debug the level of complexity of S12X applications. Nohau's full-emulator therefore supports the use of both external & internal trace and triggers, simultaneously.

The External Trace includes a number of features that are necessary to debug the level of complexity of S12X applications, and are not present on the Internal Trace:

- Deep 1,000,000 Trace Frame memory
- Recording time-stamp, user pins, Resets & Power-Downs
- Recording the entire executing history (not only change-of-flow)
- Simultaneous recording of both instruction execution, and data read and write accesses
- Performance analyzer
- Code Coverage
- More sophisticated and versatile triggers
- More versatile filter (to narrow down and focus trace recording)

On the other hand

Only the internal trace can record and trigger on XGATE operations (the external trace cannot)

Important Background on Nohau's HCS12 support (pre-S12X)

Important Background on Nohau's HCS12 support (pre-S12X)

Nohau has the Most Complete Emulator and BDM Support for the HCS12 Family:

- The only vendor with Full Emulator & BDM support for all the different HCS12 Derivatives

- Multiple Important Debugging Features that are available only on the Nohau HCS12 Emulator

Nohau HCS12 Derivatives with Both Full-Emulator & BDM Support

HCS12 'A' Family
MC9S12 A512, A256, A128 & A64

HCS12 'B' Family
MC9S12 B256, B128 & B64

HCS12 'C' Family
MC9S12 C128, C96, C64 & C32

HCS12 'D' Family
MC9S12 DP512, DJ512, DT512, DP256, DT256, DJ256,DG256, DT128, DJ128, DG128, DB128, DJ64, D64, D32

HCS12 'E' Family
MC9S12 E256, E128, E64 & E32

HCS12 'H' Family
MC9S12 H256, H128

HCS12 'K' Family
MC9S12 KT256, KG256, KG128, K64 & K32

HCS12 'T' Family
MC9S12 T64

Only Supported by Nohau

Supported by Nohau and other emulator makers

Nohau offers the largest number of HCS12 Full-Emulator CPU-Modules

1. CPU-MC9S12B128-25 - supports the B256, B128 & B64
2. CPU-MC9S12C128-25 - supports the C128, C96 & C64
3. CPU-MC9S12C32-25 - supports the C32
4. CPU-MC9S12DP512-25 - supports the DP512, DT512, DJ512 & A512
5. CPU-MC9S12DP256-25 - supports the DP256
6. CPU-MC9S12DT256-25 - supports the DT256, DJ256, DG256 & A256
7. CPU-MC9S12DT128-25 - supports the DT128, DJ128, DG128 & A128
8. CPU-MC9S12DJ64-25 - supports the DJ64, D64 & A64
9. CPU-MC9S12D32-25 - supports the D32
10. CPU-MC-S12E128-25 - supports the E256, E128, E64 & E32
11. CPU-MC9S12H256-16 - supports the H256 & H128
12. CPU-MC9S12KG128-25 - supports the KT256, KG256, KG128, K64 & K32
13. CPU-MC9S12T64-16 - supports the T64

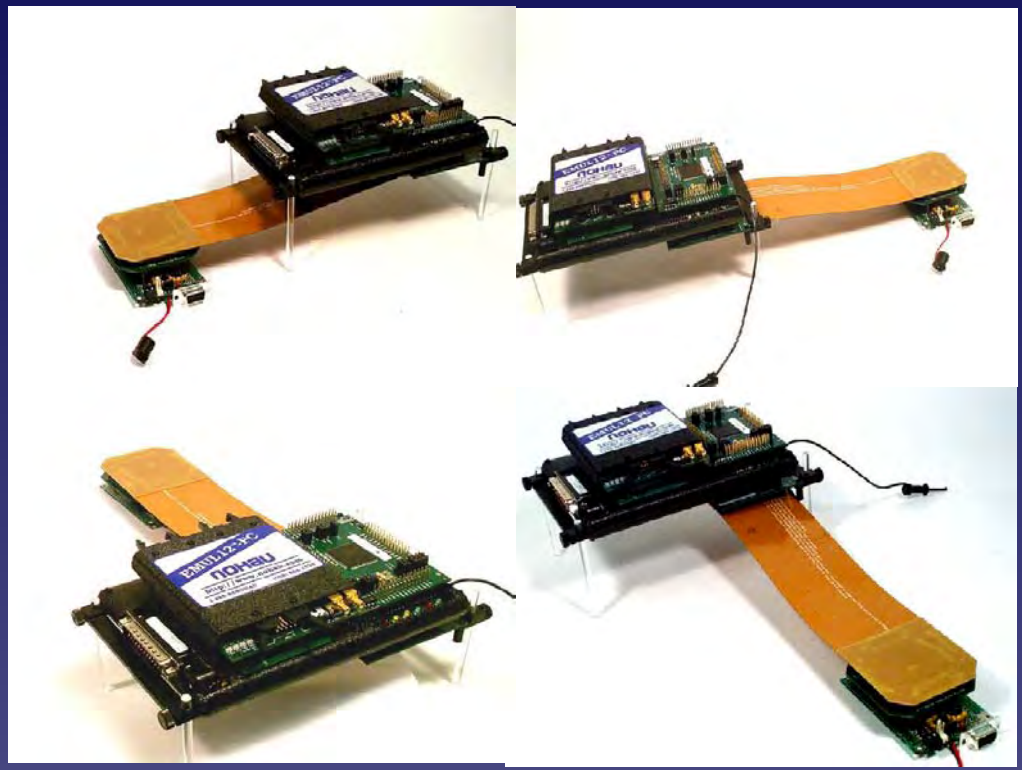
HCS12 Emulator Features available only from Nohau

- Full-Speed 25MHz operation at both 5V and 3.3V
- The HCS12 emulator works in practice to 32MHz bus speed today – this means:
  - smaller leap to S12X - 40MHz applications
  - solid operation for S12 - 25MHz applications
- Extensive support and Trace recording of all the HCS12 Operating Conditions including:
  Going through and out of Reset, COP Watchdog Reset, STOP & WAIT Power-Down modes, Clock Loss Limp-Home mode, and full PLL use including frequent speed-changes

More Important Features available only from Nohau

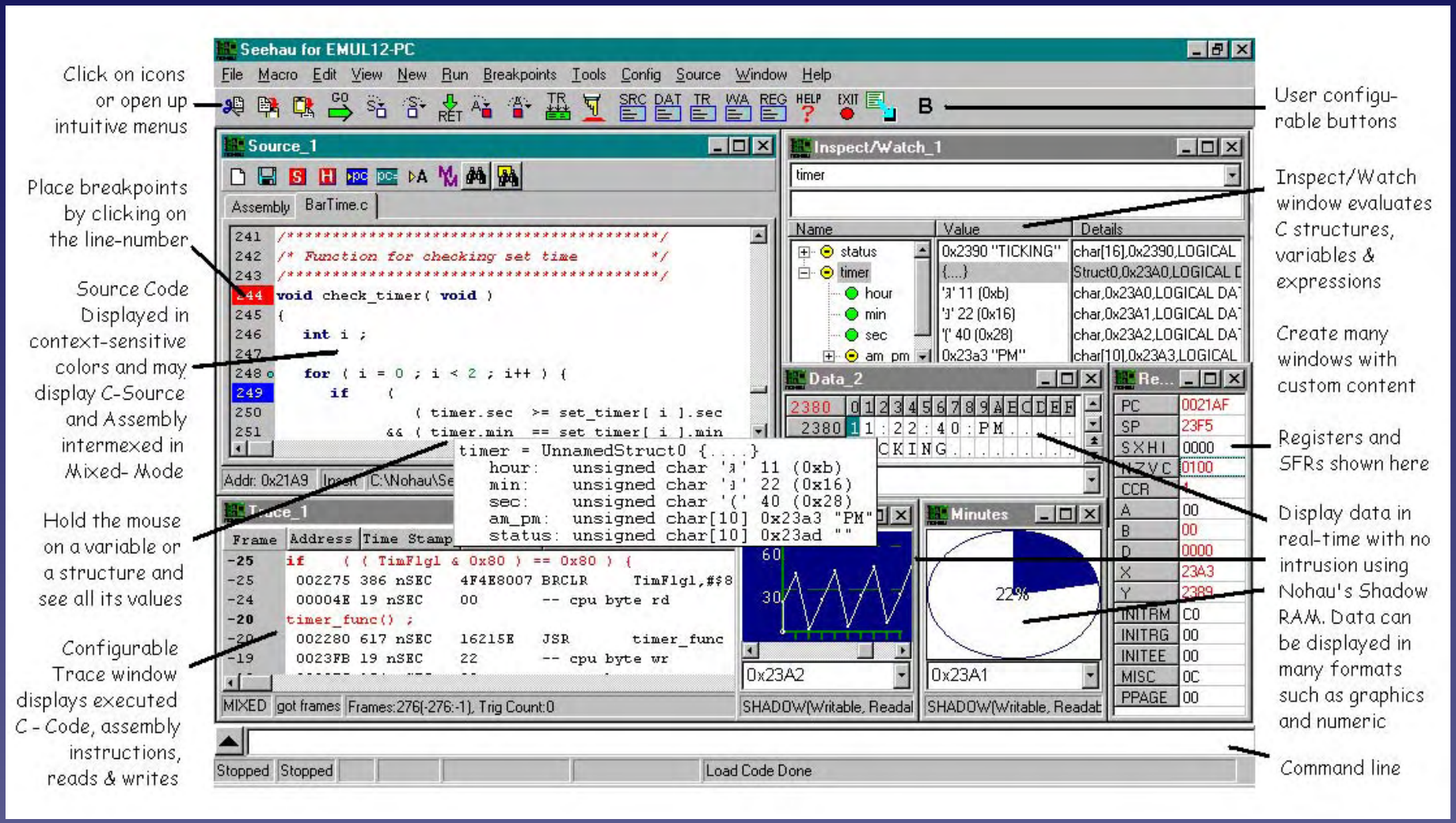
- The only HCS12 Emulator that supports Expanded Mode Targets
- Full CMOS Port Replacement Unit – Like the HCS12 silicon - at both 5V and 3.3V
- Fast and Flexible Flex-Cable target adapters allow escaping from targets at any of 4 directions
- The very intuitive Seehau GUI is easy to get started with, yet powerful and includes all the advanced debug features

Escaping From the Target at Any of 4 Directions



HCS12 Target Boards are often buried deep between modules, with very limited access to the HCS12 target board. The Nohau Flex-Cable resolves this problem by allowing to escape from the target, and connect to the full-emulator, in any of 4 directions. The flex-cable is also designed for high-speed operation above 100MHz, and includes controlled impedance and shielding

The Intuitive Seehau User-Interface



OSEK Awareness

Support of following OSEKs has been validated so far:

- Vector osCAN ORTI 2.1
- ETAS / Live-Devices ORTI 2.0
- Motorola/Metrowerks ORTI 2.0

OSEK support includes comprehensive OSEK awareness, including time-line task-service graphs, stacks usage, active task, etc.

See: http://www.icetech.com/appnotes/osek_users_manual.pdf for more details on the OSEK support package

Motorola People Say about the Nohau HCS12 Emulator:

"Development support from companies such as Nohau is critical to the success of our HCS12 family. Not only does Nohau provide an excellent intuitive development environment for our HCS12 microcontroller products, but they also have great international presence to support newly developing regions."

Kevin Kilbane
Strategic Marketing Manager
Motorola's 8/16 Bit Products Division
Austin Texas.

Motorola People Say about the Nohau HCS12 Emulator:

"It is an excellent tool. I am very impressed indeed. The package is comprehensive, and I am satisfied that this is a robust evaluation solution. I found the Seehau software very easy to use. You have obviously put a lot of development time into this. I was able to get up and tracing in a matter of half an hour after opening the box. The software is extremely intuitive, but will satisfy the advanced user. Good work! The USB interface is great. The emulator POD construction is good - I really like the modular concept of daughtercards. From what I have seen I 100% believe that this tool is well designed, well thought out and easy to use. I would be happy to recommend this unit to our mutual customers as an excellent development tool for our HCS12 devices."

Grant More, FAE, 8/16 Bit Products Division, EMEA Transportation & Standard Products Group, East Kilbride, Scotland

Motorola People Say about the Nohau HCS12 Emulator:

"I think that this Emulator is great. I could start using it since the first day I had it, especially because of the Getting Started Guide, which is helpful for making the first tests. The Hardware is robust (at least what I have tested) and with a lot of capabilities. I have been working with some of its modules like the DAC, PWM, PFM, SCI, Timers, and all of them have worked perfectly. The Seehau utility is excellent for debugging, specially for the breakpoints and the Shadow Memory which is excellent and improves incredibly the design and debug of a program. Also the description and manipulation of registers in a separate window is very helpful. I think that this could be an excellent tool for developing new application with the HCS12E128 microcontroller and it improve greatly the design and debug times."

Luis Reynoso, FAE, Motorola SPS, LAC North, Guadalajara Mexico

Important Background on Nohau's S12X support

Important Background on Nohau's S12X support

- Nohau's S12X emulator is designed from the ground-up, specifically to support the S12X. It is therefore fitted by design to the S12X architecture, and supports the S12X in the most accurate and fullest manner. Its compact architecture is also a significant advantage in meeting the challenging 40MHz and higher speed operation of the S12X family

- Nohau maintained detailed discussions with the Motorola S12X design team, throughout the S12X silicon design process, concerning how to make the S12X more emulator-friendly. Nohau contributed many technical points which were adopted by Motorola and are implemented in the S12X silicon. The results of these deep discussions are specific S12X features that are supported in the most complete manner on the Nohau emulator

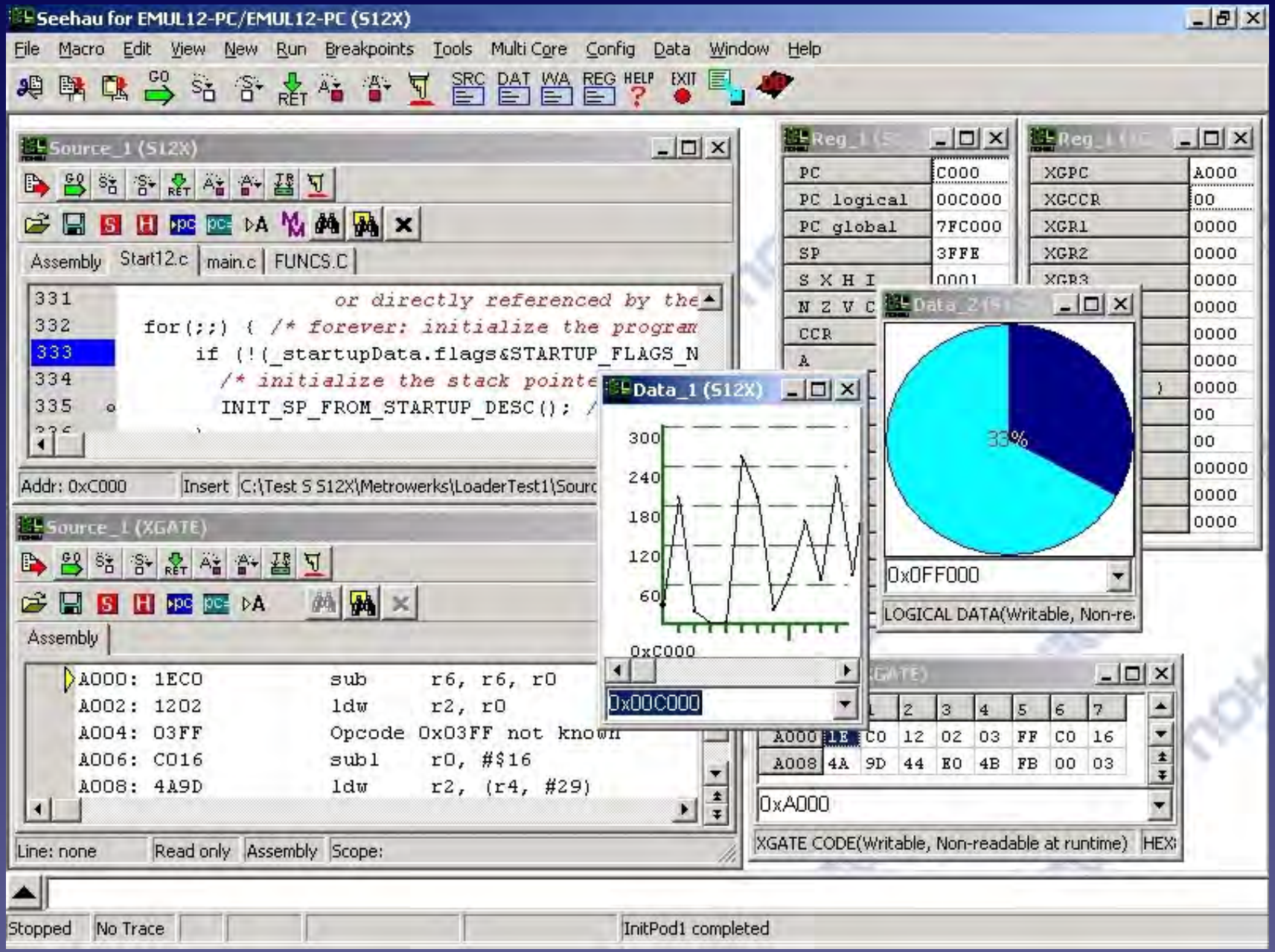
Example of a few S12X emulation relevant changes: (by the Motorola S12X design manager)

1. Two new modes fully dedicated to emulation
   Emulation of Single Chip Mode ; Emulation of Expanded Mode
   Expanded narrow mod has been removed
2. Non-multiplexed expanded bus
3. Bi-directional 16-Bit Data bus
4. **Uni-directional Address bus shared with Internal visibility data and pipestatus signals**
5. Additional pipe-status signal to indicate interrupt vector fetch
6. Unstretched ECLK and 2xECLK output
7. 1.5cycle access time (the access time of S12X@40MHz is roughly the same as for an S12@25MHz)
8. Two cycle access for all registers which need to be replaced by external hardware in emulation modes.
9. Input for a high level is reduced to ca 2.0V to allow 3V input avoiding external level shifters
   Attention: The ports will however do a full 5V drive
10. **TAGHI & TAGLO input are active out of reset in emulation modes**
11. TAGHI is a dedicated input and not shared w/ BGND pin anymore. This allows a concurrent use of BDM based debugging with full chip emulation
12. **BDM is enabled out of reset in emulation modes**
13. **BDM runs on bus clock (i.e. PLL if enabled) out of reset in emulation modes**
14. Configuration by external pin in emulation mode whether data is read from internal flash or from emulator memory, allowing "observe only" emulators
15. INITRG, INITEE, INITRM registers removed => no replacement required. Linear address-space with 23Bits
16. Attention: COP can be enabled out of reset using a NVM option register => Only erased parts should go into an emulator unless unsecured and software should be executed out of Flash.

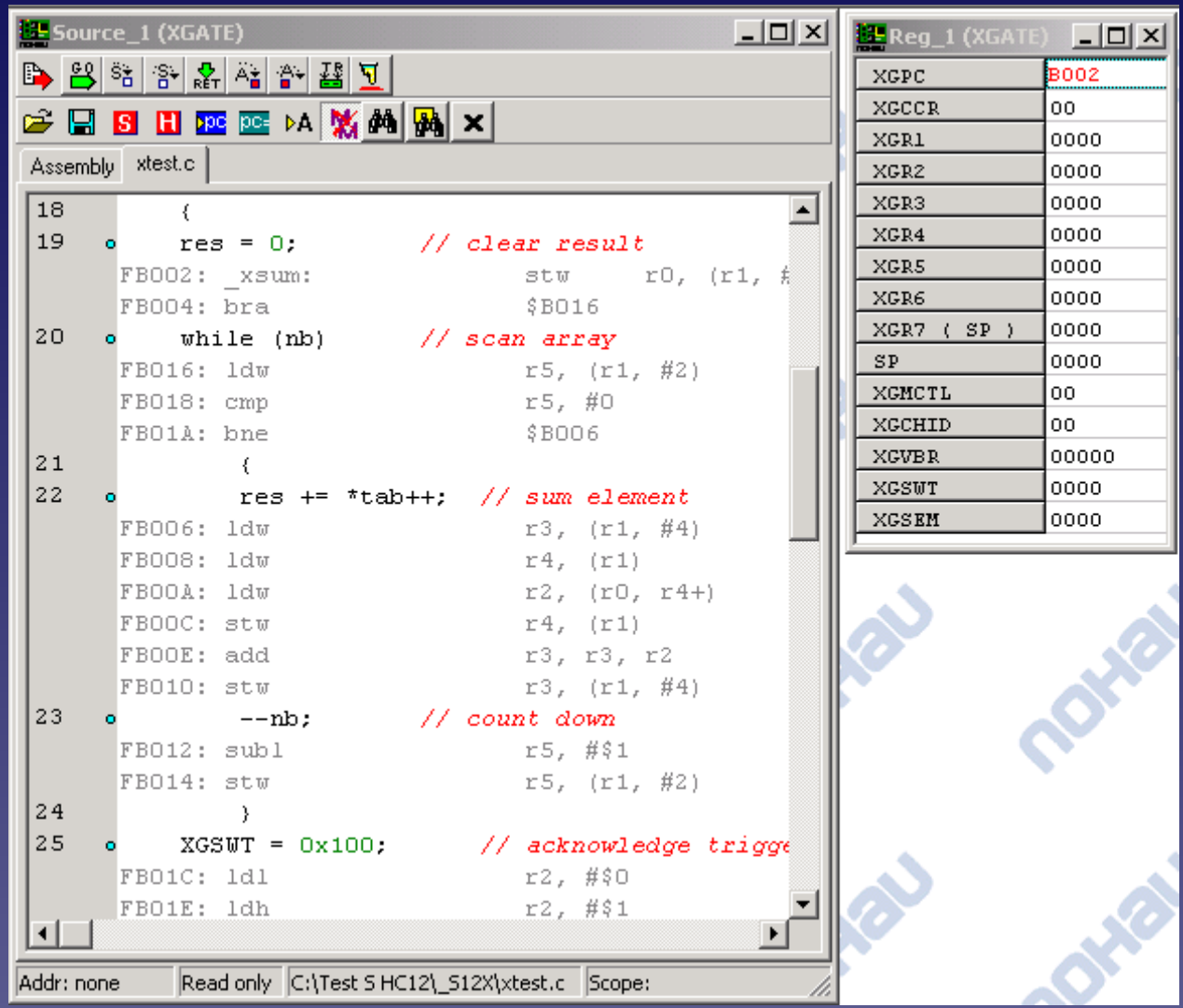
Changes which were suggested by Nohau

Some Seehau-S12X screen-shots

Dual-core Seehau S12X and XGATE



XGATE Source & Assembly in Mixed-Mode

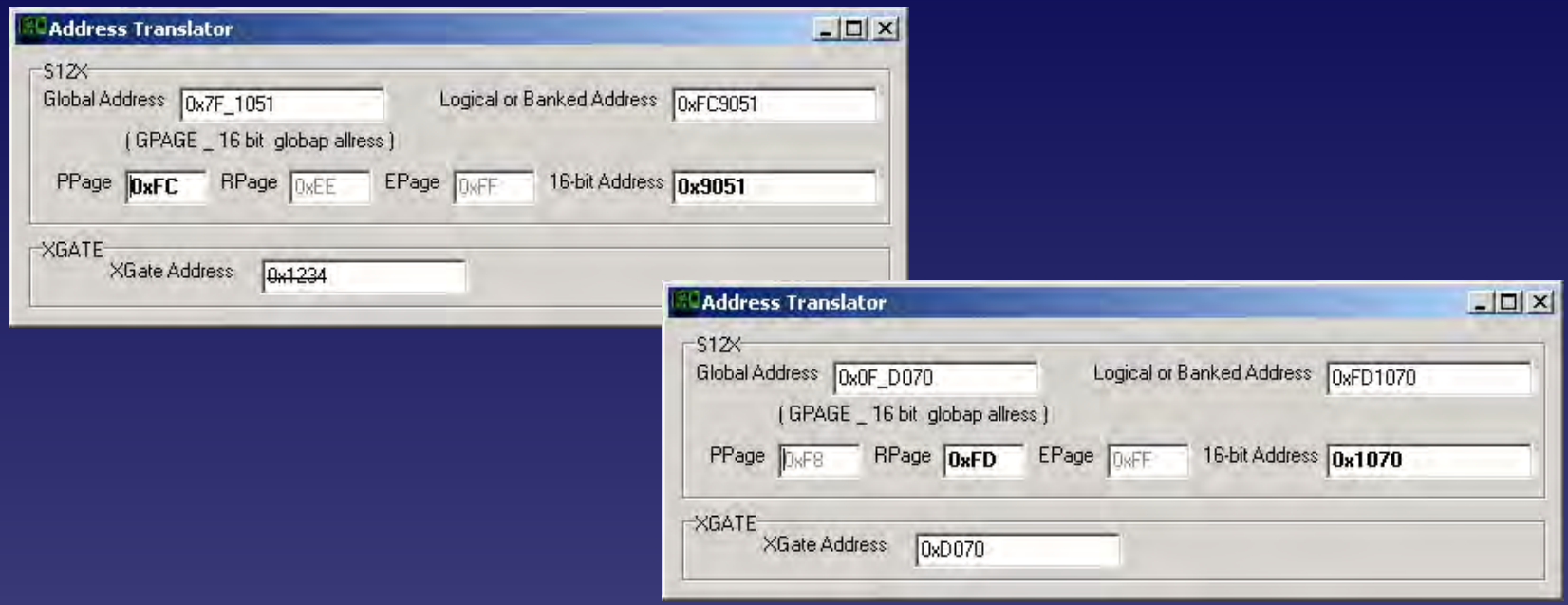


S12X Global & Logical Addressing Support

In the S12X it is possible to represent addresses in Global or Logical addressing

Seehau S12X extensively supports representing and automatically translating Global to Logical and vice-versa

S12X Address Translator



- In order to assist users in the frequent address translation which is needed in the S12X development process, Seehau includes A “Global” – “Logical” – “XGate” Address Translator window
- Users Enter the address in one form, click enter, and receive back the address in all other possible forms

Nohau can give web-based detailed demos of the HCS12 and S12X Emulator, including:

- Quick familiarization with the Emulator & the Seehau user interface
- The Visual-Basic Macro capabilities
- OSEK awareness
- COP Watchdog Reset debug support
- Power-Downs debug support
- Limp-Home debug support

Contact Nohau to schedule a web-based demo

How to Contact us?

Nohau headquarter (California USA):

Email: sales@icetech.com

Tel: +1-650-375-0409

Web: http://www.icetech.com/

Nohau HCS12 tools web-page: http://www.icetech.com/emul12pc.html

Nohau S12X tools web-page: http://www.icetech.com/s12x

Nohau HC12 Project Manager

Email: support@icetech.com