ISAN - Integrated System for Autonomous Navigation

An open-source YOLOL project made by **Collective** for the Starbase Community

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<< PUBLIC RELEASE >>

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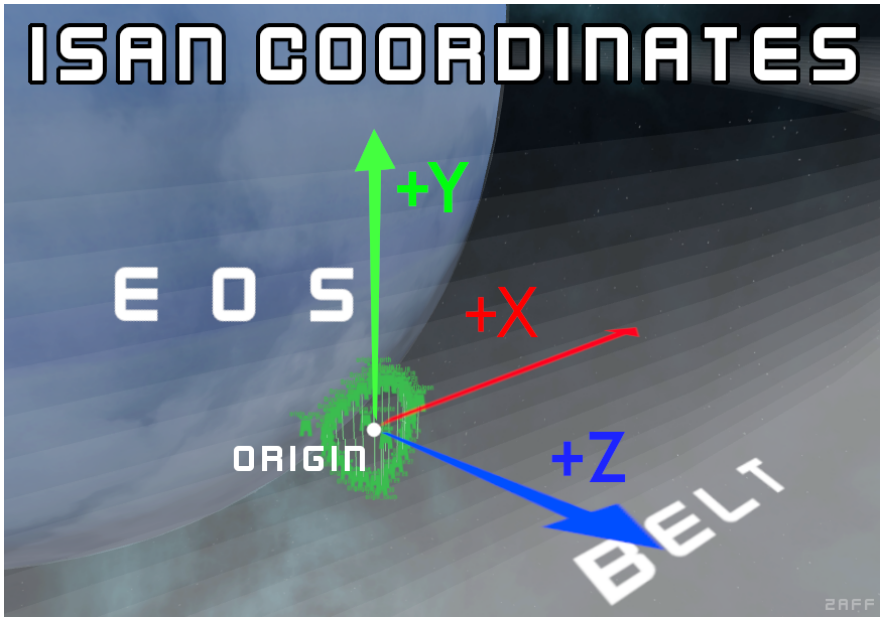
>> Introduction

ISAN is a **navigation system** within Starbase, developed by Collective. When installed on a ship, it **calculates your X, Y, and Z coordinates in space.** The coordinates are relative to the Origin 'ringle', as show in this image:

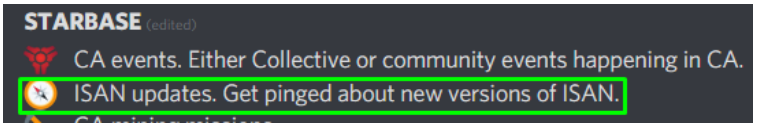


Positive axis	Orientation	Towards beacon
+X	Sideways, across the belt. "Right" if looking at planet Eos from Origin spawn.	origin_east
+Y	"Up" from Origin. The same hemisphere that the sun orbits.	origin_north
+Z	Into the belt, away from planet Eos.	

Limitations

- ISAN has a maximum range of 900-1000 km, depending on direction.
- ISAN gradually loses accuracy when approaching max range.
- In ship workshop / test flight, the Z and Y will switch places.

From everyone here at **Collective R&D**, particularly the **ISAN development team**, we **hope you enjoy ISAN**! Subscribe to updates in the **#notifications** channel in the Collective Discord to get notified when a new version of ISAN is released.



We also have a channel for `#isan_tech_support` but you may find that reading through this document thoroughly will provide most answers.

>> The modes

ISAN has two modes; **Mono** and **Quad**

- **ISAN Mono** only requires 1 reciever but is less accurate while moving.
- **ISAN Quad** requires 4 recievers to retain good accuracy while moving.
    - *In case of receiver damage, **Quad** switches back into **Mono***

	Mono (M)	Quad (Q)
Accuracy while moving	±100m	**±50m**
Accuracy while stationary	**±1m**	±5m
Required Nav Receivers	**1**	4
Required YOLOL chip	1 Basic or Advanced*	
Max range from Origin	~1,000,000 meters	
Refresh rate**	0.6 seconds	

*__Basic chip__ grants __position__, but you'll need an __advanced__ chip to display __speed__.
** __Refresh rate__ is increased by 0.2 seconds when enabling __speed__ or __prediction__.

>> Installing ISAN **Mono**

(Video installation guide)

Hardware requirements:

0. A **power source.**
1. A **small navigation receiver.** Place it anywhere on your ship. Orientation does not matter. Ensure it's bolted to a **hardpoint** with cable connection.
2. A **yolol chip** inside a **yolol chip socket** / **chip reader**:
   - **Basic** chip if you only want to see position.
   - **Advanced** chip if you also want to see ship speed.
   Ensure cable connection to the socket/reader.
3. A visible **text panel**. Ensure the text panel has connection to a panel base.

ISAN Mono setup:

4. Use the Universal tool (U key) to **rename** data fields in the navigation receiver:

Device	Data field to rename →	New field **NAME**
Navigation receiver	SignalStrength	A
Navigation receiver	TargetMessage	AT

5. Set the **value** of the **receiver**'s **ListenAngle** to **180**
6. Set the **value** of the **text panel**'s **PanelValue** to **_** (underscore)

Device	Data field NAME	New field **VALUE**
Navigation receiver	ListenAngle	180
Text panel	PanelValue	_

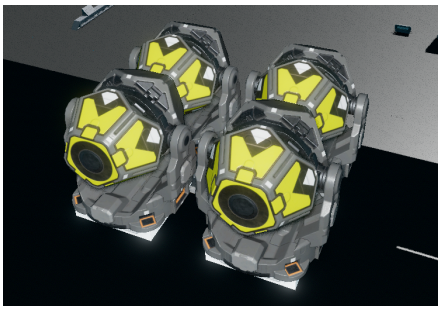
7. Once done, the **receiver** should look like this:

Message	0
a	0
ListenAngle	180
at	0
TargetFrequency	1
Frequency	0

8. Copy and paste the ISAN code into the chip. Enjoy ISAN!

>> Installing ISAN **Quad**

⚠ **It is recommended that you understand ISAN Mono before installing ISAN Quad.**



Hardware requirements:

0. A **power source**.
1. Four **small navigation receivers.** Place them as **close together as possible** anywhere on your ship. Ensure they're all bolted to **hardpoints** with cable connection.
2. A **yolol chip** inside a **yolol chip socket** / **chip reader**:
   - **Basic** chip if you only want to see position.
   - **Advanced** chip if you also want to see ship speed.
   Ensure cable connection to the socket/reader.
3. A visible **text panel**. Ensure the text panel has connection to a panel base.

ISAN Quad setup:

4. We will now refer to the four receivers as **A, B, C, D**. Order doesn't matter. Use the Universal tool (U key) to **rename** data fields **names**. With **#** being a placeholder for the receiver letter; rename **SignalStrength** to **#** and **TargetMessage** to **#T**:

Device	Rename: SignalStrength	Rename: TargetMessage
Receiver A	A	AT
Receiver B	B	BT
Receiver C	C	CT
Receiver D	D	DT

5. Set the **value** of **ListenAngle** in **all four receivers** to **180**.
6. Set the **value** of the **text panel**'s **PanelValue** to **_** (underscore)

Device	Data field NAME	New field **VALUE**
Receiver A Receiver B Receiver C Receiver D	ListenAngle	180
Text panel	PanelValue	_

7. Copy and paste the ISAN code into the chip. Enjoy ISAN!

>> ISAN YOLOL code

Mono and Quad use the same code and will automatically adapt. To Install ISAN v2:

1. Open the YOLOL chip and this documentation (at **isan.to/doc**)
2. Copy each of the **20 lines** below into the YOLOL chip, one line at a time. Press **enter** to save when done.
3. If you encounter **strange issues** with ISAN; double-check that your code is equal to this one. Copying incorrectly seems to be a very common mistake.

You can edit **line 01** to enable **optional features**, each costing **0.2**s delay:

4. **Prediction option**: Set **po=0** to improve linear accuracy on ISAN Mono.
   ⚠ Note: Prediction only works on Mono. Quad will still outperform Mono-P.
5. **Speed option**: Set **so=0** to add speed approximation.
   ⚠ Note: Requires an advanced chip. If used on Mono, also enable Prediction.

```
01 Ai=1000 w=1000 po=1 so=1 COLLECTIVE+=ISAN sv=(1-so)*18 ds=so sq=0.5
02 z="origin_" a=z+"north" f=z+"south" g=z+"east" z+="west" ms=""
03 up=" POS  :_\n     " :at=a :bt=f :ct=g :dt=z :_=up+"\nBooting\nISAN"
04 ri=:_ mx=up+"Q\nX: " my="\nY: " mz="\nZ: " ss="" x/=so-1 ms="\n\nS: "
05 e=1279116.788 j=1279315.653 k=295462.833 ll=-202102.766 p=60 mo="M"
06 t=-218955.76 n=319959.864 o=1386614.499 pp=1387810.136 vv=15+po
07 h=-159981.854 r=-159995.737 s=159977.118 tt=160000.474 v=1000000
08 i=v-:a b=v-:b c=v-:c d=v-:d i*=i b*=b c*=c d*=d u/=:a u=8 mm=mx goto16
09 :at=f i=v-:a i*=i ar=(i-la)/4 la=i u/=:a u=10 mm=up+mo+"\nX: " gotovv
10 :at=g b=v-:a b*=b br=(b-lb)/4 lb=b u/=:a u=11 gotovv
11 :at=z c=v-:a c*=c cr=(c-lc)/4 lc=c u/=:a u=12 gotovv
12 :at=a d=v-:a d*=d dr=(d-ld)/4 ld=d u/=:a u=9  gotovv
13 :_=up+"\n   Loss\n    Of\n  Signal!" goto 13-10*(:a>0)
14 x=:_ :_=up+"\nReceiver(s) damaged." goto 14-14*(x=="")
15 i+=ar b+=br c+=cr d+=dr // ISAN v2 Documentation: isan.to/doc
16 xx=i/e+b/j+c/k+d/ll yy=i/t+b/n+c/o+d/pp zz=i/h+b/r+c/s+d/tt ww=u*ds
17 xy=:_=="" :_=mm+xx/Ai*w+my+yy/Ai*w+mz+zz/Ai*w+ms+ss gotosv+ww+v*xy
18 l+=xx ay+=yy az+=zz x=l-px y=ay-py q=az-m sv+=(ii++%3)>1 gotou
19 ss=(x*x+y*y+q*q)^sq/(p-3*vv) px=l py=ay m=az l=0 ay=0 az=0 sv=18 gotou
20 xy=:_ :_=up+"\n\n  Streamer\n    Mode" goto 20-20*(xy=="")
```

(Plaintext version here)

>> ISAN Errors

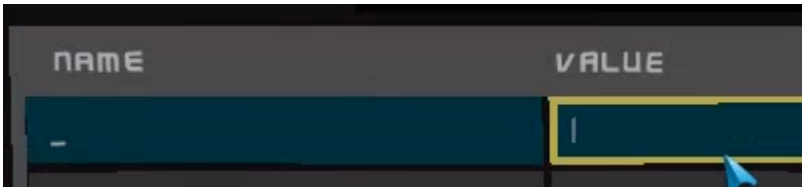
Text on screen	Cause
`Loss of Signal`	Any of the radio receivers are not picking up a signal from the stations ISAN relies on. This will show when leaving ISAN range (900-1000km).
`Receiver(s) Damaged`	The “A” receiver is damaged. If ISAN Quad takes damage in other receivers, this message will be displayed until ISAN switches to Mono.
`Streamer Mode` *(Unable to exit)*	If code is not correctly entered into the chip, or you are attempting to use the speedometre on a basic chip, ISAN will default to Streamer Mode and you will be unable to exit it until the code is entered correctly.
`_: 0`	The text panel is not connected to the cable network.

>> Streamer Mode / Reboot

“Have you tried turning it off and on again?” - ISAN Tech Support

ISAN comes equipped with a **streamer mode** to hide your coordinates. It doubles as the way to reboot the system.

- To toggle streamer mode: Press **U** on the text panel and delete the entire text panel **value** including the quotes (“”). This is faster using Ctrl+A.



- When toggling back, ISAN will reboot. Try doing this first if you encounter any issue or have changed settings.

>> Modules

Modules are a way for users to expand upon ISAN's functionality. The ISAN team has several ISAN modules in development, but until then, feel free to develop your own. ISAN by default requires **no external memory fields except for the direct '_' text panel.** If you wish to enable external modules:

- On YOLOL lines **16, 17 & 18,** prefix the variables **'XX'**, **'YY'** & **'ZZ'** with a **':'**
- Install a **memory chip** containing the **'XX'**, **'YY'** and **'ZZ'** fields.

(⚠This is only necessary if using **external modules**. Ignore if using "normal ISAN")

>> FAQ

Question	Answer
Why won't my ISAN work?	Double-check tutorial steps, check ISAN errors, exact data field names, code equality. Then check the errors table. Otherwise get help from someone who installed ISAN or Collective's #isan_tech_support
I bought a ship with ISAN. Why won't it work?	It's likely using old, outdated ISAN code. You can upgrade to ISAN v2 using this doc. Note that any ISAN information or ships made before August 2021 is outdated.
Can I sell ISAN ships or chips? (Using ingame Starbase credits of course)	Yes. ISAN is free and open-source.
Why "ISAN"?	**I**ntegrated **S**ystem for **A**utonomous **N**avigation. Catchy, easy-to-say acronym. Pronounced "Eye-Sand" without 'd'. It's not just "Space GPS", but a wider collection of navigation related tools developed by Collective.
Can ISAN be used to track me?	No. Receivers are one-way.
What is the ISAN.to Starmap?	An ISAN-compatible Starbase map developed by Collective. Note that usage of Starmap requires us to log certain information for analytics, debugging and preventing abuse.
Can ISAN.to be used to track me?	If you decide to post coordinates on a public layer, yes. Otherwise no, coordinates remain private. Feel free to avoid the map if you don't trust Starmap's Webmaster.
How does ISAN work?	Multilateration of 4 station transmitters.
Why is Quad more accurate than Mono?	Quad receives all 4 transmissions at once, whereas Mono has to cycle through each, taking samples from different locations when moving.
Is ISAN licenced?	Yes, ISAN is licenced under GNU public licence v3. *(won't mean anything to you unless you're working on our GitHub)*

>> Credits & Commentary

ISAN began as a small project I made public on a whim, but has grown to be a main-stay of many Starbase ships. I've encountered hundreds of people on this journey, ranging from interested YOLOL developers to faction repersentatives, each a brighter spark than the last. It's a rollercoaster, but one I plan on staying on. Thank you reader for using ISAN, your kind words, support and exaltation have been a bright 'lighthouse' in the darkness.

- *Solon, Kernel of Collective R&D and ISAN Project Leader*

Current Version:

- **Solon** - *Project Leader*
- ***Azurethi*** - *Lead Developer*
- ***CYLON members*** - *YOLOL debugging assistance*
- ***Zaff -*** *ISAN Documentation*

Previous Versions:

- **Solon** - *Development of ISAN v0*
- **Lumi Virtual** - *Development of ISAN v1*
- **Strikeeaglechase** - *Development of offsets and ISAN code, ISAN Starmap*
- **MuNk** - *Code consultation*
- **Nordwolf** - *Development of ISAN 0.5*
- **Battle_Wrath** - *Various design ideas and general help*
- **Archduke** - *Invaluable support and document writeup*
- **Zaff** - *Usability consultation, documentation*
- **Meboy100** - *Le rubber duck (test subject)*